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UPHEAVALS AND DEPRESSIONS IN THE PACIFIC AND ON THE AUSTRALIAN COAST.*

By WILLIAM CAMPBELL THOMSON,

Commander s.s. *Aramac*.

So much has been said and written about the Great Barrier Reef of Australia and the Coral Islands of the Pacific by men whose names have become, as it were, household words in the scientific world, that it would be presumption on my part to take up the time of this meeting with anything but a passing glance at my subject.

It has been my good fortune during the last 30 years to have frequent opportunities of studying the formation of many of the islands in the South Pacific, and also on the Barrier Reef of Australia. During the many voyages I have made, I have had numerous opportunities of landing on the islands and reefs—opportunities which I never neglected; and it was my privilege to be associated with Professor Agassiz during two of his scientific expeditions.

Not having a scientific reputation at stake—being but a humble searcher after truth, not wedded to any particular school, nor bound by any theory—I am in a position to see two great leaks in the transmission of truth—the one between the observer and the compiler, and the other in the case of an observer with a theory, who unconsciously often squares the facts to fit his theory. It is too often the case that theories are built up upon but a slender foundation, and fail lamentably in elucidating phenomena.

Great physical changes are everywhere apparent. They have been going on for countless ages, and are still in progress; but the

* Read at the Royal Geographical Society of Australasia, Queensland, December 9, 1904.

human span is far too limited to mark the change from sea-bed to mountain-peak. All we can say is, it was there; it is here. Although spasmodic disturbances such as that at Krakatoa give us some idea, even that great disturbance pales into insignificance when we find traces of the sea-bed on the highest points of the Himalaya Mountains.

Herodotus, who lived over 400 years before the Christian era, noted the existence of sea-shells on the tops of mountains, and concluded that the sea and the land had changed places. And, coming nearer home, an examination of the eastern side of Australia, extending to the eastward as far as the Friendly Islands, reveals the fact that the mountains and the rocks, emblems of eternity, are as variable as the shadow of an aspen leaf.

For many years there has been a general belief that the so-called coral reefs and islands have been built up from the depths of ocean by a minute insect; and so great a hold has this idea taken on the general mind that it has become embalmed in prose and poetry.

A careful examination of the reefs and islands in the Friendly, Samoan, and Fiji Groups, also of the Great Barrier Reef, shows that extensive observation is necessary before the causes that have led to great physical changes can be discovered. When in command of the steamers chartered by Professor Agassiz during his examination of the coral reefs, I had ample opportunities of obtaining new facts and of comparing them with the results of personal observation in former years; and I am of opinion that the two principal factors in bringing about the changes to be observed are upheaval and depression.

An examination of a map of the east coast of Australia, especially north of Brisbane, shows that the great submarine plateau extending to the edge of the Barrier Reef was at one time part of the mainland, the geological features being the same. The islands lying between the shore and the reef, which represent a former coast range, have undergone great erosion and denudation; and the sea-bottom clearly shows this by the amount of silicious and granitic mud that dredging reveals. On this continental granitic base the coral grows, spreading laterally. I have never found live coral below seven fathoms, nor above a point just below low-water mark.

The healthy growth of coral depends greatly on the purity of the water. On the flats near Bowen, and in other places near the mouths of rivers where the water is muddy, the coral is dead or diseased, showing a bluish colour near the centre of the coral spike. On the outer edge of the Barrier Reef the coral is seen at its best, because the clean water of the ocean washes over it. As a general rule, coral may be compared to a fungous growth overlying other matter.

There is one remarkable feature that is very noticeable along the whole of the Barrier Reef, namely, the presence of great blocks of dead coral, reaching often a height of eight or ten feet. This indicates the original height of the reef, and shows that an upheaval has taken place since the depression of the coast line. In no case have I found, in any of the islands of the Barrier Reef, coral overlaid by marine mud, a feature not uncommon in Fiji. There is an apparent contradiction to this near Gladstone, where large masses of coral are found inland and near the mouth of the Boyne River overlaid by mud; but this is the result of river deposit. There is, however, one thing certain, namely, that the Boyne River must have had some other outlet during the growth of the coral; and considerable changes in the general conditions must have taken place since then. It may also be mentioned that in Moreton Bay great masses of dead coral are found at Mud Island, where coral could not live subject to the influence of the Brisbane River as it now exists.

North from Sandy Cape the submerged plateau extends eastward for a distance of 140 miles, when the sea deepens from 45 fathoms to 160 fathoms, whilst 50 miles farther to the east the depth is 1,280 fathoms. This submerged plateau narrows in off Cape Tribulation to 20 miles, and again at Cape Melville and Cape Direction, whilst it widens to 120 miles off Cape York, with a depth of water varying from 15 to 30 fathoms, and extends to the southern shores of New Guinea, which is now connected with the continent only by the ties of flora and fauna. South from Cape Moreton the breadth of the submerged land does not exceed 20 miles, and the grade is much steeper, reaching an ocean depth of 1,200 fathoms off Cape Byron. From Port Stephens to off Wollongong and abreast of Newcastle the plateau widens to 30 miles, with not more than 70 fathoms at the outer edge. From this we can understand the great coal beds extending seaward under the harbour of Newcastle. Off Bulli the coal cliffs dip into the sea, showing the depression to the eastward.

Continuing to glance along the coast to the southward the precipitous dip is quite apparent, while round to the westward the bare granitic islands and headlands in the vicinity of Wilson's Promontory afford abundant evidence that Australia and Tasmania were formerly one. Inland and around Melbourne undulations of land are marked by the presence of marine fossils at some considerable distance above and beyond the sea.

An examination of the Friendly, Samoan, and Fiji Groups clearly shows that coral growth has played but a secondary part in their construction. The whole of the Friendly Islands are upon a volcanic plateau, and several of the volcanoes have been in active operation within the last few years.

In Vavau, coral strata can be seen several hundreds of feet above the present sea level, not only on the sea cliffs, but throughout the whole island—or islands—for they are so fitted, as it were, close into each other, with points overlapping and narrow but deep channels between, that the group might easily be regarded as one island. The southern portion shows the basalt more freely than the northern, which has been overlaid by volcanic dust.

The Haapai Group, which lies south, but a short distance has been lifted up from some considerable depth below low-water since the coral was formed. The islands a little to the westward are all of volcanic origin. Lette, for instance, is a perfect cone; and outbursts of smoke and fire are not infrequent, while some of the smaller islets show signs of internal fire. The high islands of Tofoa and Kau occasionally emit smoke, and are also of volcanic origin.

Tonga, with the numerous small islets on the north side, is similar to Haapai in formation, but has a larger deposit of tufa overlying the coral. These islands were discovered by Tasman in 1643. Pylstaart Island, the southern-most of the Friendly Group, is the only one retaining the original name given by the discoverer. Eua Island, divided by a few miles from Tonga, is also of volcanic origin.

The shores of all these islands and reefs are overlaid by living coral that continues to grow down as the upheaval goes on, or the reverse if there is a depression.

In the south-eastern part of Fiji the leading feature is that of up-lifted coral reefs, often reaching an altitude of 200 or 300 feet. The soil filling up the coral crevices is composed of marine mud, which suits the casuarina or she oak, so often met with in Australia. Outcrops of basalt are noticeable on several of the islands to the northward, where Mango Island presents a conglomerate of coral and basalt overlaid by a thick deposit of volcanic dust.

Vanua Balevu, better known as Loma Loma, shows an older formation, and, in addition to the presence of the characteristic above alluded to, dykes of quartz are seen, in which gold has been found, while on the beach hot springs are not uncommon. From here northwards raised coral reefs are the leading feature.

At Wailangilala Island, at the northern end of a lagoon where the depth of water in the centre is not more than 23 fathoms, boring operations were carried on by Professor Agassiz to a depth of 82 feet through marine debris, consisting of broken shells and coral, but the solid reef was not reached. This bore was abandoned after an examination of several of the islands to the S.W., particularly Vatu Vara, which has an altitude of 1,030 feet of coral lying upon a basaltic base, and Naitamba, where the east end of the island has been lifted up and the western part depressed, showing the basalt

freely. Without going into an exhaustive explanation, it may be assumed that where such upheavals as that of Vatu Vara take place, depressions of equal magnitude must follow. And if these undulations can be measured by a sextant, it is useless to bore, when boring to a depth of 82 feet revealed only debris—and that but an accumulation caused by the going down of an island similar to Vatu Vara.

About 40 miles to the westward of Vatu Vara, volcanic agency is more pronounced. Totoya Island is distinctly the rim of a sunken volcano, with the south side blown out. In the centre of the crater the greatest depth is 30 fathoms, with a bottom of black volcanic mud. We steamed through the "Gut" and came to anchor close to the northern side in 19 fathoms. During the afternoon we climbed to the summit of the northern rim, 1,000 feet high, where a splendid view could be obtained. The deep black water in the crater where the vessel lay, was relieved by patches of yellow sand on the beach, backed by the rich foliage of bread-fruit trees and cocoanut palms, through whose various shades of green could be seen several native villages. Higher up the side of this vast basin, patches of yam, vine, and tapioca—both native and imported—broke the monotony of the rank brown grass. On a ridge near the summit a fine patch of lemon-grass was growing luxuriantly side by side with our old Australian friend. It may be remarked, in passing, that lemon-grass originally came from South America, during the early colonial days, when our wheat supplies were drawn from Chili, and it is possible that seeds may have been carried here when the gaps were not so wide as at present.

Some 25 miles to the north and west from here is the Island of Moala, which is distinctly of volcanic origin, and is surrounded by a coral reef, between which and the land the bottom is composed of volcanic mud.

Running north on the same meridian through the Goro Sea, where there is a depth of 1,450 fathoms, the water shallows to 800 fathoms as we approach another group of volcanic origin—that of Taviuni and the adjacent islands. On the summit of the Island of Taviuni there is a well-defined crater, now filled with water and vegetable slime. To the eastward, separated by Tasman Strait, is another extinct crater.

North from here, surrounded by reefs, are several volcanic islands. The principal, Thombia, has the crater open to the N.E.; but, as there was only about 8 feet of water on the sill or lip, we were unable to enter. As we steamed past the opening we looked into a dark dismal basin. Whirlwinds of mist and rain dashing against the cliffs made it one of the most forbidding places we had visited, and we were glad to turn and seek shelter in Tasman Strait.

Wherever we turn in Oceania there are evidences of great upheavals and depressions. The atolls of *Motu Levu* and *Moto Laili* clearly show a subsidence, while the dead coral and marine debris being heaped up, form a rim round probably the highest peak of the land that has sunk. To the eastward of these atolls is a long line of reef running north and south. Until a few years ago there were two small islets at the southern end; now there is but one, and that is so eroded that it is only a question of a very few years when it also will disappear. From a careful examination of the whole of this reef, there is, no doubt, that at one time it was dry land, and probably it formed one of those lagoon islands before it subsided to its present level.

On the south side of Nairai Island, and within the reef, is the small island of *Kobo*, which is of basaltic formation, and has a height of 80 feet. Prior to landing on this island, observations were taken, including the bearings of distant islands. At the landing place the compass showed no change; but, when carried to the summit, the needle deflected to an angle of 86 degrees from the meridian, showing unmistakably the presence of iron. At several places in the Fiji Group the same phenomenon exists.

On Viti Levu (the largest of the group) great upheavals have taken place. Along the south-eastern end great masses of marine mud are elevated 200 or 300 feet above the present sea-level. Near the town of Suva similar changes have taken place. Coral and marine mud in alternate layers—with an occasional stratum of water-worn pebbles—can be seen over 100 feet up the cliffs at *Waloo* Creek. Embedded in this mud are broken sections of foraminifera similar to those found at the bottom of the Atlantic Ocean.

In the immediate vicinity of the mouth of the Rewa River, great physical changes have taken place at a comparatively recent date, and the land has evidently extended for some considerable distance towards the S.E. The natives report that alligators were seen in the river so late as the early part of the last century. On the south side of the island, at the mouth of the Sigatoka River, there are masses of black iron sand, highly magnetic, which have been carried down by the water, whilst marine mud—in some instances raised more than 100 feet—can be seen along the whole of the south coast.

The western part of Fiji, including the outlying islands of Malolo and the Yasawa Group, are all of basaltic formation, and, judging by the granulation, must be of great age. The decomposition of this rock forms a rich soil, but leaves bare frowning peaks that speak eloquently of the passing of these islands into the stage known as atolls or lagoon islands.

LAGOON ISLANDS.

Many and curious are the theories that have been advanced to account for these basin-shaped islands. What we understand by a lagoon island is a ring of land—often vegetated—enclosing a sheet of water of moderate depth, while outside the water is hundreds of fathoms deep.

A long acquaintance with Oceania suggests the idea that these lagoon islands are much older than many of their more imposing neighbours. They have passed through the period of upheaval and denudation, and are now on the descending grade. Erosion and denudation having done their work in levelling down, Ocean has taken them under her especial care, and corals, which all the while have been growing around the edge, have formed a level extending over the last land reduced or depressed.

Here the great economy of nature can be seen, inasmuch as the sea claims rent from the coral for affording it a place whereon to grow, while the dead coral and mollusc remains are heaped up by the waves directed by the prevailing winds. (Sketch of atoll: Shape—roughly speaking—like an ellipse; direction of longer diameter from S.E. to N.W. Prevailing winds, during nine months of the year, S.E.; during the other three months, N.W.) These masses of broken coral form a solid bank, in which are embedded shells of immense size of the Gigas family. Should a temporary upheaval take place, these ridges soon become covered with vegetation, while the hollow in the centre becomes a placid lake. Standing on the rim of an atoll, scientific research is hallowed by the Muse "as the long-back breakers croon their endless ocean legends to the lazy, locked lagoon."

Even where there is no appearance of an upheaval or a depression, it is almost incredible the amount of marine debris that is heaped up around the rims of those lagoon islands. The original island—we will suppose it to have been of basaltic formation—has gradually decomposed and sunk, while Ocean has fed the rim with a never-ending supply of coral, dead and alive, and other marine debris.

Such is a brief outline of the ideas that are suggested by years of experience among the coral reefs of the Pacific. Upheaval and depression are the two grand notes in the harmony of nature that sound the requiem of past continents, and the prelude to further development. But so continuous is the process that the observer fails to find a pause in the creative, or in the destructive, energy of nature, whose laws regulate the whorls of the minutest shells and the most fragile coraline, and control the submergence of a continent thousands of feet below the surface of the sea, or the upheaval of

submerged land until the coral peaks of Vatu Vara are lost in the clouds.

Hitherto I have given no particulars with reference to the Samoan Islands; and, as the leading features of the Fiji and Friendly Groups apply to them also, I feel that I should be taking up valuable time in their description. It is sufficient to say that in the whole of the group there is evidence of volcanic agency, that denudation is doing its work, and that coral is overlying the shores, but, as far as I know, there are no upheaved coral reefs.

Thus far I have endeavoured to show that the presence of land or its disappearance is due mainly to undulations of the surface caused by internal activity, and that some of our highest mountains have been lifted from the bottom of the sea, while others have gone down. Such changes cannot but make us pause and reflect that there is more scientific truth in the Mosaic account of the Creation than the casual reader would at first suppose—"Let the waters under the Heaven be gathered together unto one place, and let the dry land appear: and it was so."

I offer these opinions as a layman who has had exceptional opportunities of studying the subject at first hand, and trust they will not prove uninteresting to the Society.

TASMAN:
A FORGOTTEN NAVIGATOR.*

By Captain W. EATON.

Mr. President, Ladies, and Gentlemen,—This being (in the phraseology of the stage) my first appearance, a few introductory remarks, presenting my credentials as it were, may not be considered altogether inopportune.

Standing here to-night, it would be quite natural, and very much in accordance with my wishes, to eulogise the aims and ideals, and also the past triumphs of Geographical Science, but I think, and you will all agree with me, that to do so would be quite superfluous, and only furnish another illustration of what is termed "painting the lily."

But a few words bearing indirectly on our subject may not be out of place.

The great kingdom of Geographical Science has many ramifications, and these ramifications are so extensive and far-reaching that, like the territories of some powerful potentate, they sometimes infringe on the boundaries of neighbouring States. For instance, when we investigate the cause and effect of earthquakes, we find ourselves on the edge of the Dominion of Geology.

The north coast of Queensland is ravaged at intervals by cyclones, and when we try to solve the laws which regulate their motion when in our vicinity, we are on the outskirts of the Domain of Meteorology.

But Nautical Discovery is distinct from all neighbouring sciences. It stands alone, and is the very foundation of the building. To the ordinary student it is also the most attractive section of the science. Philology, Ethnology, Zoology, and the other abstruse *'ologies* which contribute their quota to rear the great geographical edifice, are less attractive, but by no means less valuable.

But to the boy, or to the grown man, the literary or the illiterate, the story of Columbus, of Cook, of Dampier, and the grand roll of Arctic and Antarctic heroes, is for ever fascinating, and inspires in present and future generations high ideals and heroic aims.

Nautical discovery occupied a pre-eminent position in the earlier stages of our geographical knowledge. It is different to-day. The 19th century gave birth to Geography as a science, as it did to

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* Read at the Royal Geographical Society of Australasia, Queensland, April 27, 1905.

Chemistry and Biology, and, I may add, to New Astronomy, and to-day as a science it embraces land and sea; and, like Chemistry and the other sciences, it is very progressive in its nature, divulging its secrets bit by bit. There is no finality in science, "for we are ancients of the earth, and in the morning of the time," and there is no royal road to geographical science. It is not like poetry, an intuitive perception. It is the one great attribute of Nature, that, like a coy maiden, she never dispenses her favours to the careless or the indifferent. He who would become an adept in interpreting her secret must (to borrow a line from the poet Burns) "assiduous wait upon her." Not to be content with an occasional mild flirtation, but to be an ardent votary and sincere seeker after truth, and have for his motto that noble line from Tennyson: "Let knowledge grow from more to more. How pleasant are the ways which lead to knowledge!"

In my younger days, we used to sing in the old Scotch Kirk a paraphrase of Scripture setting forth the beauties of Divine wisdom—

"Her ways are ways of pleasantness and all
"Her paths are peace."

And so it is with knowledge, "Her ways," etc.

It may happen, as it often does happen in our work-a-day world, that we meet with crosses and troubles, but when these assail us, we have, in the pursuit and enjoyment of knowledge, the purest consolation, and which will enable us to rise on the stepping-stones of our worldly selves to higher things.

The present age is characterised by an intensely intellectual activity. The ordinary mind is bewildered by the daily discoveries and inventions of science. Some of these are so far-reaching that we ask ourselves when the limit to these wonders will be reached, and whether we will yet attain to a more divine intelligence, so that we may fathom those great mysteries, Time and Space.

We have a complacent feeling that Providence has hitherto kept many secrets of Nature under lock and key for our special behoof; that all through the ages men groped their way from the cradle to the grave, enveloped in the murkiest ignorance.

But we are beginning to have an uneasy feeling or suspicion that in many of our intellectual triumphs we have been forestalled. The Chinese claim many of our good things, and their claims cannot be altogether ignored. We cannot dispute their title to the mariner's compass, the discovery of which is not due to modern civilisation, but is mentioned, as illustrating the case in point. Also the hieroglyphics of old Nile, and the clay tablets of Babylon, and Nineveh, are making us reluctantly aware, that those old Eastern people knew more than we are inclined to credit them with.

The steamship, however, we can safely claim as our own. "The glory that was Greece and the grandeur that was Rome" have nothing in common with this. Between the Roman war galley which carried Julius Cæsar to the shores of Britain and our modern battleship, there is a great gulf. The twenty-knot steamer is one of our modern wonders. All the resources and scientific appliances of the age have been called into requisition to produce the Atlantic liner.

However, when we read of some record-breaking Atlantic passage, where time and space have been abridged and the very elements subjected to our use, let us not forget that there were brave men before Agamemnon; that there were brave old ships which did great deeds, long before steamships were dreamt of; long before the China clipper, robed in studding sails, raced across the Indian Ocean; even long before Captain Cook existed, and he represents, to the average Australian, everything connected with our maritime history.

As there have been phases of civilisation long anterior to our own, so the sea of our ancestors has a history rivalling in interest, if not in importance, that of the present.

In those days when the world was wide, in that period which we still fondly call "the good old times" (although we have no desire for its return); when Australia and New Zealand, with their populous cities, and marvellous goldfields, were alike unknown, when the United States and Canada did not exist; when China and Japan were names inseparably connected with Marco Polo and Prester John, the records of our early maritime history were full of tragic interest. To the modern pioneers of the sea might be applied the old Biblical summing up, that "there were giants in the earth in those days."

Their ships were what we would term small; perhaps about the average size of the now extinct collier brig. We read of Bartholomew Diaz, who first rounded the Cape of Good Hope, in 1486, that his two vessels were 50 tons each, and to him the Cape was a veritable Cape of Storms. Ten years later, Vasco di Gama performed the same voyage in two crafts of 150 and 120 tons. John Davis, towards the end of the 16th century, penetrated the Arctic regions to almost 73° North latitude, in a clinker-built yawl of 20 tons, and discovered the strait which bears his name. The famous Drake, in the earlier part of his career, made a voyage to the Spanish Main in two vessels of 70 and 25 tons respectively. In 1576 Martin Frobisher voyaged to the Arctic regions in search of a N.W. passage to China, with a vessel of 25 tons and a pinnace of 10 tons. Columbus discovered the New World and encountered the winter storms of the North Atlantic in small vessels not any larger than our river and coasting craft.

Only one of his vessels was decked over all. It is to us wonderful that the daring expeditions of those days into unknown seas should have been undertaken in such vessels.

Those early navigators relate their adventures in the quaintest of language, in which there is scarcely ever a note of complaint.

They are cast away on inhospitable shores. They are cut off by hostile savages. Their ships are often charnel houses of disease and death. They lose their masts in Cape storms, and their rudders on unknown shoals. Their food and their water are often of the roughest kind. All these and a host of other vicissitudes common enough in those days are endured, and described without the slightest tinge of our modern every-day sensationalism.

Their ships, although small, were generally strongly built. They are depicted on old maps and charts with very bluff bows and high, square sterns, innocent of the least approach to what is termed *run*. Consequently, they were slow in turning to windward. The incessant buffeting of stormy seas and the dreadful calms of the tropics often caused them to leak badly. There were none of the preserved foods and medicinal aids with which to-day we ward off scurvy, that once fatal scourge of the sea.

It may be interesting to give here the bill of fare, or what is now termed the scale of provisions, for the seamen of that period. The particulars here quoted apply specially to the vessels of a Dutch expedition, which sailed from the Texel, in 1643, bound for Chili, and other possible places, and commanded by Hendrick Brouer, whom the annalist characterises as "a man of much experience." With possible slight differences, it would also doubtless apply to the English shipping of that time.

"To each man one good cheese for the whole voyage.

"Three pounds of biscuit, one quartern of vinegar, and a pound of butter a week.

"Sundays:—$\frac{3}{4}$ of a pound of salt beef.

"Mondays and Wednesdays:—6 ounces of salted cod.

"Tuesdays and Saturdays:—$\frac{1}{4}$ of a pound of stock fish.

"Thursdays and Fridays:—$\frac{3}{4}$ of a pound of bacon and grey peas.

"At all times as much boiled oatmeal as they choose to eat." This scale of provisions contrasts not unfavourably with the present writer's experience of twenty-five years ago in the average British vessel. The amount of vinegar to the salt meat and salt fish is perhaps a little out of proportion, like Falstaff's ha'porth of bread to the intolerable two gallons of sack. John Davis, of Davis Straits fame, tells us particulars of his men's dietary, in one of his Arctic voyages. Each mess of five men was to receive four pounds of bread daily, twelve quarts of beer, six stock fish, and an extra gill of peas on salt meat days.

Viewed from our standpoint, the appliances for the navigation of their vessels were of the rudest description. The latitude was found in a very rough manner up to the end of the sixteenth century by a very primitive instrument, termed a cross-staff. Captain John Davis, just mentioned, invented a superior instrument, called a back-staff. Hadley's quadrant, now in use, did not make its appearance until nearly a century and a half later. The speed of the vessel was found by flinging overboard, astern, what is termed a logship, with line attached. As the vessel sailed onward the line was allowed to run out. The line was marked by knots, and the time of its running out measured by a minute glass. Therefore, as sixty seconds are to an hour, so was the distance between each knot to a nautical mile. This was termed "heaving the log," and is the origin of our present way of denoting the speed of a ship as so many knots or miles an hour. This method was in universal use from that period until our steamboat age. Now we have what is known as the patent log, which measures a far greater speed than did its old-fashioned predecessor.

To ascertain the longitude was the supreme difficulty. The method had been proposed of observing the distance of the moon from the sun, with simultaneous altitudes—what is now known as taking a lunar. But the instruments necessary were then too rough for such a delicate operation.

In 1605 a Spanish expedition sailed from Peru for "the discovery of lands and seas in Southern parts." It was commanded by Quiros and Torres, two eminent navigators. The narrative of the voyage was written by Torres. He gives the latitude of the various positions of his vessels no less than seventeen times, but never once alludes to longitude.

The charts then in use were rude and unreliable. Map-making was known to the Greeks and Romans. The most celebrated geographer of ancient times was Ptolemy, an Alexandrian of the second century, who originated a system which, strange to say, was for thirteen centuries, with some slight variations, accepted as representing the true configuration of the earth's surface.

His geography dealt not only with the known, but the unknown. Outside of the Roman world, as Indo-China, Northern Europe, and the greater part of Africa, his system of geography, owing to lack of scientific observation, was rough and incorrect. It was principally based on vague rumours, or the grotesque tales of adventurous travellers.

During the Middle Ages his system obtained universal credence. Very little was done during those dreary centuries to expand or improve his conceptions. Original thought was not a characteristic of those times. It was dangerous to be original.

As a specimen of the Ptolemaic geography, a map by a later follower of Ptolemy places the southern extremity of Africa at about the 16th parallel of latitude, but by way of compensation connects it with an elongation of the coast of China.

Mr. R. H. Major, in his work, "Early Voyages," gives the following translation of the text which accompanies this map: "Thirty "degrees from Java the less, is Gatigara, nineteen degrees on the "other side of the Equinoctial, toward the South. Of lands beyond "this point, nothing is known, for navigation has not been extended "further, and it is impossible to proceed by land, in consequences "of the large lakes, and lofty mountains in those parts. It is said, "that there is the site of the Terrestrial Paradise."

As another instance of Ptolemy's geography, Ceylon is made to extend to 15 degrees of latitude and 12 of longitude; consequently it is made fourteen times as large as the reality.

China was also placed 60 degrees nearer to Western Europe, and led Columbus to imagine that the distance to the New World was so much less, "and that a moderately short voyage westward would bring them to its shores, or to the extensive and wealthy islands which lie adjacent."*

The great ocean covering two-thirds of our earth was mysterious and unknown. It is interesting to reflect that, in all probability, it had ever been a vast solitude, undisturbed by man's puny handiwork; where the trade-wind, and the gale, and the hurricane, had been, during vast ages—(ere ever man was)—doing Nature's work, as they do, to-day.

An eminent writer of the Middle Ages, and who is quoted by Washington Irving, says: "No one is able to verify anything con-"cerning the ocean, on account of its difficult and perilous naviga-"tion, its great obscurity, its profound depth, and frequent tempests; "through fear of its mighty fishes, and haughty winds. There is "no mariner who dares to enter into its deep waters; or, if any "have done so, they have merely kept along its coasts, fearful of "departing from them." But the Portuguese navigators, creeping southwards along the African coast, bit by bit, rounding the Cape of Good Hope, and eventually reaching India, gave a stimulus to geographical research.

Cartography, hitherto of an archaic and academic nature, became elevated to the dignity of a useful science. The invention of printing, and consequent revival of letters, gave powerful aid in extending geographical knowledge. Printed works by Spanish and Portuguese navigators could now be passed from hand to hand,

* Washington Irving's "Life of Colombus."

instead of being buried in inaccessible libraries, as had been the former works of a similar character.

On the decline of the Spanish and Portuguese maritime ascendancy, Holland, then in all the flush of recent victory over its great enemy Spain, came to the front as the world's greatest sea power.

The Dutch, in spite of the enmity of their Portuguese and Spanish rivals, contrived to profit by their superior maritime experience, and produced several eminent cartographers. Linschoten, a Dutchman, who had voyaged to the East, produced, in 1595, his Itinerario, illustrated with maps. Lucas Wagenaar, also of Holland, published the first Marine Atlas in 1584.

These, and other works of a similar nature, were a powerful aid to Dutch exploration. The first appearance of the Dutch in the East was in 1596, just eight years after the Spanish Armada. To reach India by the Cape of Good Hope, they had to run the gauntlet of the Portuguese naval power, and by the Cape Horn route they had to fight their bitter enemy Spain.

They therefore, in the last years of the 16th century, made three different attempts to reach the East by the North-east passage of the Arctic regions. Each attempt was unsuccessful. Their third voyage was specially tragic. Although having no special connection with our subject, one incident in connection with this voyage may be interesting.

Their vessel got hopelessly jammed by the ice, and the crew had to winter in Nova Zembla*. Here their great commander, Barentz, died, and the following summer the crew escaped in boats. In 1871 the hut in which they had wintered was discovered. It had been strongly built, and had withstood the Arctic storms of 274 years. Everything in the hut was almost in the same condition as when these emaciated Dutch sailors had left, nearly three centuries before. The clock on the wall—the cooking pans over the fire-place—a book on navigation in the Dutch language, by a Spanish author—an account of China, by Mendoza—a flute which still gave out a few notes of music—a halbert leaning against the wall—and the shoes of a boy who had died. The Arctic climate has a wonderful preserving power.

In the beginning of the 17th century we find the Dutch in possession of Java; and now the sturdy figure of Abel Jansen Tasman looms dimly through the centuries. Navigator and explorer, he occupies, by reason of his discoveries, a commanding position among the world's great seamen. Without the fiery genius of Drake, or the scientific and observant mind of Dampier, he possessed abilities of no common order.

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* Novaya Zemlya.

Like our Captain Cook, he was of lowly origin, and commenced his sea life with the Dutch fishermen in the North Sea. He joined the service of the Dutch East India company as a common sailor, and rose rapidly to the position of a master of a vessel, or skipper, as the Dutch term it. He had already commanded in two important trading expeditions from Batavia to Japan and the North Pacific, and proved himself a capable seaman and bold leader of men. Some of his maps are still extant, and show considerable knowledge of cartography. Dr. Thomson, Secretary of the Royal Geographical Society of Australasia, Queensland, relates in his "Round the World," having seen, in the possession of Prince Roland Bonaparte, President of the French Geographical Society, Paris, Tasman's original manuscript map of Australia.

In 1642, when forty years of age, Tasman was commissioned by the Council of Batavia to discover the extent of the unknown South Continent. Very little of this land was then known. There was no conception of its extent or configuration. The planet Mars, in our own day, with its reputed canals, is not more mysterious.

The existence of a great Southern continent—Terra Australis Incognita—had long been the belief of cosmographers. As there were large continents in the Northern Hemisphere, it was argued that, in accordance with the usual natural law of compensation, there should be equally large continents in the Southern Hemisphere.

It was not until Captain Cook had sailed over the site of those imaginary lands that the theory was finally dissipated.

Since the Dutch had established themselves in the East, this unknown land had engaged their attention. They had visited, but not explored, the Gulf of Carpentaria. They had also touched on the West and South coasts, but only in an accidental manner. There is no authentic record of the east coast having been visited by them.

At this time the great Australian Continent, the future empire of the South, was lying, like Tennyson's sleeping princess, waiting for the discoverer to wake her into animated life.

Two vessels were commissioned for the voyage. They were bluff-bowed galliots—the "Heemskirk" and the "Zeehaan." The "Heemskirk" was in that day classified as a yacht. Quite the opposite in everything to our modern aristocratic vessel of that name. The "Zeehaan" ranked in size and equipment as a fly-boat, and was smaller than her consort, the "Heemskirk."

The expedition was not purely exploratory. The very practical and hard headed directors of the Dutch East India Company were never actuated by any adventurous ideals; neither did they believe that the honour of exploration, like the practice of virtue, was its own reward. Profitable dividends were the chief ends in view.

For this purpose the two vessels were laden with all sorts of goods, under the care and management of a merchant or supercargo. It may be interesting to mention, parenthetically, that Tasman's monthly salary was 80 guilders, or, in English money, £6 13s. 4d. Two years later, this was increased to 100 guilders, or £9 6s. 8d.—not by any means an income commensurate with the importance of his position, even allowing for the greater value of money at that period.

Tasman, on taking command of the expedition, commences his journal, or log, as follows:—

"Journal of Description by me, Abel Jansen Tasman, of a "voyage from Batavia for making discoveries of the unknown South "land in the year 1642. May God Almighty be pleased to give His "blessing to the voyage. Amen."

The modern skipper does not, as a rule, enter such a valediction in his log, and in the experience of many years I have never known one who expressed such sentiments verbally. This by the way.

At first we might imagine that Tasman must have been of an unusually religious nature. But this does not necessarily follow. It was an age which believed in the supernatural; when religion dominated every phase of Politics, every condition of Art, and nearly every department of Literature. It coloured all personality, and permeated the life and thought of the people. It is, therefore, not surprising that this spiritual and religious temperament was often strangely blended with cruel matter of fact action.

Carlyle has lately pictured to us the true Cromwell as a Christian soldier and statesman, but the Irish nation has not forgiven the cruel massacre of Drogheda.

Sir John Hawkins, when engaged raiding with fire and sword the negroes for transport to the Spanish Main, had daily prayers on his vessels. When becalmed for twenty-eight days in the tropical latitudes, he expected great mortality among the closely-packed slaves; "but," says his biographer, "the Almighty God, who never suffereth His elect to perish, sent us the ordinary trade-wind."

We read, also, that Drake's men partook of the Holy Communion in Magellan Straits, before commencing their career of pillage in the South Seas. Afterwards, when he had raided the Spanish galleon from the Philippines, he released the empty ship, and gave the unfortunate Spanish captain a letter of safe conduct, the religious sentiments of which would have done honour to any evangelist.

Tasman left Batavia in August, 1642, and entered the Indian Ocean by the Sunda Straits. He ran across from land to land, with a fresh south-east trade-wind on his port quarter, and arrived at Mauritius after a rapid passage of 22 days.

This, although rather a circular course for the South land, and if imitated would not be approved of by the modern shipowner, was under the conditions, the best track that could have been followed. It enabled Tasman to take a great sweep of the Southern Ocean, and gave him fair winds shortly after leaving Mauritius.

On his run from Batavia across the Indian Ocean, he had apparently no means of knowing his longitude, unless by what is termed dead reckoning, and which can never be depended on after a few days' run. He therefore adopted the usual plan of that time, and also of long afterwards, of getting into the latitude of his destination, and then running on that parallel until arrival.

Tasman's longitudes, as might be expected, were very far from being correct. In his journal he says, "By our reckoning, we were still 200 miles east of Mauritius when we saw it." That is, he had over-run his distance, by dead reckoning, an average of 9 miles every 24 hours, but his ships, for the greater part of the way, were under the favouring influence of the Equatorial current, the extent and influence of which he was probably ignorant.

The island of Mauritius was at this time a Dutch possession. When discovered, in 1507, by the Portuguese, it was uninhabited, and showed no traces of ever having been the abode of man. Its fauna was meagre, for it only contained one mammal, a large fruit-eating bat.

It is interesting to know that this small island was the home of that celebrated but now extinct bird, the Dodo. This curious bird is described by naturalists as a massive, clumsy, and defenceless creature; about as large as a swan; covered with downy feathers; having a very strong hooked bill; short, stout legs; a short tail, and wings too small for flight. Intimacy with Europeans has not been favourable to many of the native races, human or otherwise. The Dodo was no exception to this rule, for about forty years after Tasman's visit it became extinct.

Forests of ebony were then plentiful in the island. Since then it has been largely cleared, to make room for the more profitable sugar-cane. Tasman tells us that while lying here he received news of a certain French vessel being in the neighbourhood. Thereupon certain of his crew were despatched to the north-west of the island, being suspicious that the Frenchman intended to cut ebony, which would not be allowed. Evidently freetrade was not a popular belief in those days. We read in Tasman's journal that during his stay here every preparation was made for their great voyage to the unknown land.

The crews were sent on shore to assist the huntsmen in catching game for present and future use. The position and rating of hunts-

men on those exploring ships is now rather a mystery, and in our modern vessels has lapsed, owing to increased facilities in every port for obtaining supplies. Ship chandlers and butchers have usurped the place of the huntsmen, and now the name is only suggestive of the modern English hunting field.

As the result of this battue, a large number of wild hogs, and wild goats, were obtained, and equally divided between the two ships. The carpenters were also sent on shore to cut firewood and spare spars.

The ships required repairs. They were both old, and one was considerably rotten. Their spars and rigging, satisfactory enough in smooth seas and tropical weather, were not altogether fit for the desolate stormy billows of the Southern Ocean. We doubt if any of our present-day sailors, even the most reckless, could be induced to sign articles in such vessels, bound on such a voyage. The opportunity was therefore taken to re-fit and repair them for possible rough weather.

Before proceeding further, I may mention that all the accounts of Tasman's present voyage are derived from his own journal. A short abstract in the Dutch language was published at Amsterdam, thirty years afterwards. In later years partial translations were given in English and French collections of voyages. A copy of the journal and of the original sketches and charts were in 1776 discovered in London in a collection of old books, and came into the possession of Sir Joseph Banks. The manuscript of the English translation is now in the British Museum. In the beginning of last century, Captain Burney published the more important parts of this translation in his "History of Discovery in the South Sea"—a work now only found in dusty libraries or private collections. Tasman's memory has received scant honour in his own country, for it was not until 1860 that his full journal was printed at Amsterdam, and given to the world.

The entire narrative is given in the most dry-as-dust manner, in a language as grey and sombre as the Southern seas, and as uninteresting as the flats and dykes of his native Holland. Throughout the journal we cannot get a glimpse of Tasman's natural self. He is to our view a mere abstraction, and we can only judge him by his deeds. This voyage proved to be one of the most important of any which had been undertaken since the first circumnavigation of the globe, but we only know its results, and in language very much akin to that of a Gazetteer.

In this characteristic he is no unworthy representative of his great countryman, William the Silent. Tasman and his officers were apparently the most unimaginative of Dutchmen. He volunteers no description of Mauritius. No mention is made of its picturesque

mountains—its coral reefs—its abundance of fish—its climatic conditions—its flora and fauna—only an island not remarkable as a profitable asset to his employers, the Dutch East India Company.

They lay at Mauritius thirty days, and on the 8th of October they weighed anchor and launched out into the great unknown sea; two tiny barques in search of a great continent. For several days the winds were variable, and the variation of the compass is noted as 23½° West.

For nineteen days after leaving Mauritius the lonely navigators give no sign; only record in the baldest of language that the winds were easterly, or westerly, or variable, as might be.

On the 27th they saw a great deal of duck-weed floating in the sea. A council of the captains and pilot was held, and in their own quaint language it was resolved to keep a man constantly at the masthead to look-out; and whosoever first discovered land, "sands, or banks, under water," should receive a reward of three reals, and a pot of arrack. This no doubt encouraged increased vigilance on the part of the Dutch sailors. We get no glimpse of their life on board, or how they passed the dreary days, with a wild waste of unknown seas around them, and a world of uncertainty ahead.

No mention is made of animal life or any other object of nature which generally attract the attention of travellers in unknown regions. They plodded on in their comfortless crafts, full of dogged, silent courage, amid the cold moaning of Southern gales. There is nothing here akin to the hopes, and fears, and anxieties, and petty jealousies, which agitated Columbus and his companions on *their* first great voyage of discovery.

After the look-out at the masthead was set, little scraps of information are doled out very sparingly. On November 4th, four weeks out, as they saw more seaweed, it was naturally conjectured that they were nearing land, and that night the ship was hove to.

The journal tells us that seals and thunnies were seen. As the approximate latitude that day was 48° South, and the longitude about 86° East, the nearest land was the island of St. Paul's, 380 miles astern. Cape Leewin was about 1,300 miles ahead. They had passed between St. Paul's and Kerguelan's Islands.

On the 6th they had a westerly gale, with snow, and it is mentioned that it was very cold. This is the first and only note of complaint that we hear from them. Their latitude was 49° South, and long. 91° East. The difference of longitude in these two days gives their speed at 160 miles in twenty-four hours—about 7 knots an hour.

They now begin to think that they are too far south, for the land they are in search of. Another council was called, when it was

proposed that they should keep to the more northerly parallel of 44° South until they had passed the 129th meridian, and then make for the parallel of 40° South, and, if no land was then seen, to keep in that parallel until 180° East was reached, and then steer North. It was therefore resolved to steer North-east until 44° South.

As they get more northerly, the westerly gales lulled, but the sea ran high from the southward, and they opined, therefore, that there was no large tract of land in that direction. On November 17th, forty days out, their latitude was 44° 15′ South, and their longitude 126° East. They found the compass variation 8° West. That is, the north point of the compass needle is drawn 8 degrees west of the true north. The magnetic pole has so changed its position in two and a half centuries that the variation in this locality is now 2° West. The variation of the compass needle was familiar enough to the navigators of Tasman's time, but to Columbus, who first observed the aberration, it occasioned great uneasiness, and much terror to his officers and crew. They had now passed Cape Leewin, and were abreast the Great Australian Bight. It shows the accuracy of Tasman's navigation when he mentions that he must now have passed that part of the South land already known, or at least as far eastward as the land which Peter Nuyts had visited fifteen years before.

That night they lay to, and at daylight sailed again eastward. On November 22nd, if Tasman had steered North about 50 miles, he would have discovered the Kangaroo Island of South Australia.

Tasman is here alarmed at the eccentricities of his compass, which swings four points, or 45 degrees. He imagines that there must be loadstones in the vicinity. Those of us who have had the pleasure of reading the voyages of the celebrated navigator, Sinbad, may remember that on one occasion his ship was wrecked when passing a distant mountain of such magnetic power that it drew every iron bolt from the sides of Sinbad's vessel, causing a general collapse.

Before the laws of magnetism were so well understood as they now are, a modified idea of a similar nature obtained credence, not only with seamen, but with minds of scientific order.

Without going to the extreme view given in Sinbad's history, as to a magnetic force acting on the ironwork of a vessel at sea, it was, and is still, a belief that there are various shores throughout the world, the rocks of which are so full of magnetic iron as to seriously interfere with the compasses of passing vessels.

The Admiralty charts call attention to such localities. The northern shores of the Gulf of Finland are of such a nature, and also the northern coast of the Gulf of St. Lawrence has in the Admiralty "Books of Direction" the same physical character.

The writer has navigated in both of these places, and can testify to the compass being sometimes unreliable to a certain extent; so much so that in the Gulf of St. Lawrence a steamer of which the writer was chief officer was sailing on what was considered a perfectly safe course, but ran ashore in the darkness, and became a total wreck.

But other views are now beginning to be adopted. It is scarcely possible to navigate a vessel with safety, so close to the shore as to influence her compass to any appreciable amount; but it is possible that a vessel may sail *over* magnetic rocks, well below the surface, but quite near enough to render her compass unsteady and erratic.

On the 24th November, their compass was again steady, as before. They were steering a course to gain the 40th parallel, when in the afternoon they saw land about 40 miles off. They had discovered Tasmania.

After a run of 47 days, mostly in stormy weather, Tasman's longitude was only 90 miles too far west; that is, by his reckoning the longitude when land was seen was 142° 24′ East. He was 40 miles off the land, which made his real longitude 144° 25′ East. It is, of course, impossible to know whether this result was due to professional skill or merely an accidental coincidence.

Fearing that the coast of this new land might have hidden dangers, they stood out to sea until morning. Next day it was calm, and the succeeding day they were blown off the land by a northerly gale; and it was not until four days after, on 1st of December, that they anchored their storm-tossed ships in what is known as Blackman Bay; whereupon Tasman piously exclaims: "We ought to lift up thankful hearts to Almighty God."

Next day the boats were sent on shore, and they returned at night with an unsatisfactory report. Water, of which they were in great need, was scarce. The country was thinly wooded, and smoke was seen in various directions. No inhabitants were seen.

The day following the Dutch flag was hoisted on shore, and the country named Van Diemen's Land, in honour of the Governor of Java.

The first landing of Columbus on the shores of the New World was dramatic and imposing. He fell on his knees and kissed the earth, while his followers, lately mutinous and dejected, now gave themselves up to the most unbounded transports of joy. Our prosaic Dutchmen were of a different calibre. The Teutonic mind of Tasman was of sterner material. It may be interesting to hear him tell, in his methodical way, how he took possession of this land:—

Afternoon.—We went with the said boats, together with the pilot, Major Francois Jacobz—the skipper, Gerrit Janz—Isack

Gilsemans, merchant of the "Zeehaan"—the junior merchant, Abraham Coomans—and our chief carpenter, Pieter Jacobz, to the S.E. corner of the bay, having with us a pole, with the company's mark cut therein, and the Prince's flag, in order to set the same up there, so that it may be evident to posterity that we have been here, and taken the said land for a possession and property. Having rowed with our boats about half way, it began to blow hard, and the sea to rise so high that the launch of the "Zeehaan," in which were the pilot-major and merchant Gilsemans, was obliged to return on board. The surf broke at such a rate that the land could not be approached without danger of the boat being dashed to pieces. We ordered the said carpenter to swim ashore, by himself, with the pole and Prince's flag; and remained with the long boat lying to the wind. We made him set up the said pole, with the flag at the top, in the earth, before a decaying tree, one of a group of four. After the carpenter had accomplished this matter, above rehearsed, in view of me, Abel Jansen Tasman, and the junior merchant, Abraham Coomans, we rowed the boat as near to the shore as we dared venture, and the said carpenter swam back again to the long boat, through the surf.

There is nothing emotional in this transaction. On the 4th of December they sailed away in a northerly direction, along the east coast, with the wind off the land, keeping a look-out for a possible watering place. Several bush fires were observed.

Here we get a glimpse of Tasman's personality. In a very characteristic note he says: "Here I should give you a description of the extent of coast and the islands near, but I hope to be excused, and refer you, for brevity's sake, to the maps made of it, and found herewith." Verily the force of taciturnity could no further go. In our present age of universal talk this silence would be indeed golden.

Tasman's most serious need at this time was fresh water. This was always the great difficulty with our early voyagers. Their fresh water, stored in barrels, was liable to leakage in bad weather, and deterioration in hot climates. Rain water was used and conserved at every opportunity.

Sir Richard Hawkins, son of Sir John, of negro traffic notoriety, commanded an expedition, composed of three vessels, to the South Seas fifty years before this. Sir Richard must have been very much in advance of that age, for in his "Observations" he says: "Our fresh water had failed us many days, by reason of our long navigation, yet with an invention I had in my ship I easily drew out of the water of the sea sufficient quantity of fresh water to sustain my people, with little expense of fuel, for with four billets of wood I stilled a hogshead of water, and therewith dressed meat for the sick and whole."

On December 5th, Tasman left Van Diemen's Land to its original solitude, and 130 years elapsed before it was again visited by a white man. Of course, Tasman believed that the land he had discovered was part of the great South Continent, and this idea prevailed until Bass and Flinders long afterwards proved Van Diemen's Land to be an island.

It was resolved to steer an east course, and for six days they had strong south-west winds. On the eighth day out, 13th December, they sighted land with high mountains, veiled in clouds. This was New Zealand.

Tasman says: "This is the second land we have discovered. We have given it the name of Staaten Land, in honour of their High Mightinesses the States-General, and also because it may be that this land is joined to Staten Land (near Cape Horn); but this uncertain."

The high land sighted by Tasman was the west coast of the South Island, just south of Cook's Straits. Steering to the north-east, he anchored in what is now known as Golden Bay. Here their boats' crews were attacked by the natives, who were as fierce and intractable then as Cook found them long afterwards. Tasman describes them of good stature, strong boned, and of a rough voice. Their colour is between brown and yellow; their hair black, which they tie up on the crown of their heads like the Japanese, and with a large white feather stuck upright in it.

Their vessels were, two narrow long canoes fastened together, upon which boards were fixed to sit on. Their paddles were more than a fathom long, and were pointed at the ends.

This is all that Tasman can tell of them, as he never got an opportunity to land. They attacked his boats without any provocation on his part as far as is known, and killed four of his men. Their canoes came out immediately afterwards in considerable numbers, and he fired on them in self-defence.

As there could be no friendly intercourse after this, he brought his ships to another anchorage, now called Tasman's Bay, near where the town of Nelson stands. Here they rode out a severe north-west gale.

Tasman narrowly escaped discovering the straits which divides the North and South Islands. This honour was reserved for Cook. He now proceeded northwards, following the trend of the west side of the North Island. Making a last effort to obtain fresh water, they anchored on the North side of the Three Kings Islands. They sent their boats away, with them the empty water barrels, but the sea ran so high and the attitude of the natives on shore was so threatening, that the boats returned to the ship.

Tasman, still short of water, left New Zealand, and steered for more hospitable shores. Captain Cook was the next white visitor to New Zealand. Neither here, nor in Van Diemen's Land, did Tasman make any attempt to explore or give shape to the lines of coast. The scientific explorer was yet to come.

The little expedition sailed away in a north-east direction, and in fifteen days discovered the Friendly Islands, or Tonga Group, lying in 20° South latitude. Here their reception was very different from that of the Maoris. The natives were mild and peaceful, and had no warlike weapons. Tasman, who could no doubt appreciate such, after his recent tragical experience, calls them "a good, peaceful people." They cultivated fields of yams, plantains, and cocoanuts. Their gardens were laid out in regular squares of bananas and other trees, the fruits of which were found very pleasant after the rough voyage. They also manufactured a kind of cloth from the bark of a tree, and altogether their condition was similar to that in which Cook afterwards found them.

They appeared to have no idea of a Supreme Being, but those we term savages are sometimes reticent in expressing their superstitious beliefs to strangers. Tasman notices with curiosity that all the elder women had their little fingers cut from both hands, but the young women had not.

But they were inveterate thieves. Tasman seems to have acted towards them in this respect, with a truly philosophic and Christian spirit. He tells us that "one of the natives was detected in stealing a pistol and a pair of gloves, the property of the skipper. We took the things from him without anger." How different from the cruel and tyrannical treatment such races have often received.

They were a simple and untutored race. We sometimes feel inclined to regret that our civilisation, which is only suited for strong and strenuous nations, should be introduced into an arcadia such as this. That the iron doctrine of the survival of the fittest should have come into action, and that even the very virtues of our boasted civilisation should lead to the deterioration and ultimate extinction of a once happy people.

Here we take leave of our little company of Dutchmen. Their future proceedings have for us no personal or scientific interest. They pursued their leisurely course northward of the Solomon Islands and New Guinea, and arrived at Batavia after a ten months' absence. Tasman finishes his journal characteristically, as follows: "We arrived at Batavia, June 15, 1643. God be praised for this happy voyage.—Amen."

Tasman's great voyage was disappointing to the Dutch East India Company. He had discovered no golden regions, or any people

eager for trade. Voyages of merely geographical discovery had for them no attraction. It is this sordid spirit in his countrymen which has stunted his well-deserved fame.

There was nothing in this expedition to fire the imagination or attract the world-wide admiration, as did the brilliant voyages of Drake or Anson, yet it was far more important than either.

Tasman ranks next to Cook as a navigator, and in the importance of his discoveries. They both possessed that happy combination of character which enforces discipline without tyranny, and also a humanity and sense of justice which conciliated the native races.

The unanimity of purpose and mutual good feeling displayed by all the members of this expedition is an agreeable contrast to the jealousies and quarrels, so common to our early exploring voyages.

Tasman lived sixteen years more. Two years after this voyage he was again in command of three exploring vessels, and made a partial survey of the Gulf of Carpentaria, and also established the continuity of the north coast of Australia, as far as the 22nd parallel of latitude. He was also employed in some minor voyages. His later years were passed at Batavia, in comfortable circumstances, and there he died, 1659.

Farewell, honest Tasman, grim, silent Dutchman; Carlyle might well have given thee a niche in his Temple of Fame.

STRADBROKE ISLAND: A GREAT NATURAL RESERVOIR AND FILTER FOR WATER.*

By G. PHILLIPS, C.E.

It is not unusual nor is it unnatural to gauge the value of things by their cost. If the oxygen we consume in our water and in our air had to be bought at so much per pound, it would be considered an extremely valuable commodity, and the man who could cheapen its production would be a benefactor.

The conversation of water has engaged the attention of man in all ages, whilst in this age the most skilful and experienced engineers are employed in the design and execution of waterworks of ever increasing magnitude.

Sir Benjamin Baker, M. Inst., C.E., who designed the celebrated cantilever bridge that spans, with its giant arms, the Firth of Forth, was still more recently employed to put a bridle on the Nile, by means of the great stone dam at Assouan, which cost £5,000,000, and holds one thousand million tons of water.

In Western Australia, nearly £3,000,000 have recently been expended in supplying water to the goldfields at Kalgoorlie, by means of the greatest pumping scheme that has yet been proposed, whereby a daily supply of between five and six million gallons is forced through a 30-inch pipe for a distance of 328 miles, and lifted to a height of 1,290 feet above the level of the storage reservoir on the coast, whilst it is now proposed to extend the supply to Menzies, a further distance of 80 miles.

Within thirty miles of the rooms of this Society, there is a vast natural reservoir that has cost the community nothing—a free gift, just as Port Jackson was a free gift to the people of New South Wales—and although this natural reservoir contains more water than the Assouan dam, whilst one of its minor leaks would supply the goldfields of West Australia, because it has cost us nothing, there is no little risk of its being overlooked and neglected. I refer to Stradbroke Island, but before describing in detail this great natural reservoir, it may be of service if I briefly indicate the alternative sources available for the supply of water to Brisbane.

OPEN RESERVOIRS.

Sites for open reservoirs with earth dams similar to those with which we are familiar at Enoggera and Gold Creek, are not rare

* Read at the Royal Geographical Society of Australasia, Queensland, May 25, 1905.

in the coastal districts, and I know of one site at Baroon Pocket, in the Blackall Range, where a very large body of water might be stored by means of an overshot dam constructed in masonry or concrete. Additional reservoirs, therefore, might be established within from 10 to 60 miles of Brisbane; but a series of isolated dams with separate mains would prove very costly and in other respects unsatisfactory, and although, no doubt, it is practicable to improve such water, the best method of precipitation or filtration still awaits practical demonstration.

Experience has shown that open reservoirs in this climate soon become nurseries for numerous aquatic growths, whose minute spores pollute and degrade the water, so that when it passes through the mains under pressures of from twenty to thirty atmospheres, with light and air excluded, it is not a matter for surprise that the water delivered to the consumer is generally in a much worse condition than might be expected from a casual inspection of the source.

It may, therefore, be accepted as an axiom, that in tropical and semi-tropical climates, water for domestic and manufacturing purposes drawn from open reservoirs with earth bottoms, must be treated by filtration or precipitation, and perhaps both.

THE BRISBANE RIVER.

The basin of the Brisbane River cannot be regarded as a desirable or satisfactory source of supply because it is liable to contamination in so many ways, whilst in times of drought the natural flow has proved inadequate for the very moderate requirements of the present. Storage in the bed of the river by means of weirs is to be deprecated on many grounds, whilst suitable sites for weirs have yet to be discovered. After heavy rain the river water is exceedingly turbid, and is quite unfit for use until sufficient time has elapsed to permit of sedimentation. On the 22nd December, 1902, the river water drawn from the pipes in Brisbane contained earthy matter in solution to the extent of 4 per cent. or 40,000 parts per million.

During the drought which culminated towards the end of 1902, the inadequacy of the natural flow of the Brisbane River was amply demonstrated.

Taking the 242 days between the 9th April and the 6th December, 1902, the temporary weir at Mount Crosby Pumping Station held up the entire natural flow of the river, and it became necessary to cut channels connecting the water holes in the bed of the river for a distance of sixty miles, so that every gallon of water that could thus be made available was sent down the channel by gravitation to supply the pumps at Mount Crosby. Had the drought continued for another week it would have been necessary to send a powerful

plant to pump water from the upper reaches of the river. Owing to the distance the water would need to travel over the heated shingle and sand, and the consequent loss by evaporation and percolation, probably less than half the quantity pumped would have reached Mount Crosby.

Many thousands of cattle died on the basin of the Brisbane River during the drought, and for several months men were employed by the Ipswich Municipal Council and the Brisbane Board of Waterworks for the purpose of removing dead cattle from the bed of the river and burning their remains. In times of drought, also, many fish die in the smaller and shallower water holes of the river, although, unfortunately, these holes have to be utilised as conduits for water drawn from the upper reaches. It is evident, therefore, that if storage in the bed, or in valleys adjacent to the bed of the river should be resorted to, that some better conduit than the river channel should be provided.

Mr. Foster-Barham, associate member Inst. C.E., late engineer-in-chief to the Brisbane Board of Waterworks, in his reports dated 9th January and 13th May, 1903, dealing with the Brisbane River supply, said:—

"The resources of the Brisbane River were severely taxed last year and the supply was only maintained by drawing upon the upper reaches. The limit to which this was possible without pumping was practically reached last December, when, fortunately, rain came. Pumping from these upper reaches would have been a very difficult operation, and the Board may be thankful that this never became necessary.

My conclusions regarding the discharge of the Brisbane River in years of drought such as 1902, may be summarised as follows:—

For consecutive periods of three months the river may cease to flow altogether.

For consecutive periods of six months the average daily discharge may not exceed 1,250,000 gallons.

For consecutive periods of nine months the average daily discharge may not exceed 2,000,000 gallons.

For consecutive periods of twelve months the average daily discharge may not exceed 3,750,000 gallons.

For consecutive periods of fifteen months the average daily discharge may not exceed 7,000,000 gallons.

Evaporation of the river and reservoir surface is allowed for in this estimate."

It is evident, from Mr. Foster-Barham's conclusions quoted above, that the Brisbane River cannot be depended upon to supply the city and suburbs by natural flow, and, bearing in mind that settlement and utilisation of the river basin for various purposes is

certain to expand from year to year with a correspondingly increased drain upon the available water, it is manifest that a more reliable source, and one less liable to pollution, should be sought without any unnecessary delay.

In the course of my professional duties extending over a period of forty-two years, I have had exceptional opportunities of making myself acquainted with the basins of all the rivers from which Brisbane might be supplied, namely, the Brisbane, Logan, Albert, Coomera, Nerang, South and North Pine, and Caboolture, as well as their numerous tributaries, so that I am not speaking without knowledge when I say, that from none of these sources can an adequate supply of pure water be obtained except at great expense for storage, sedimentation, filtration, and delivery.

Some five years ago I mentally set myself the task of discovering a considerable area of sandstone or granite formation within reach of Brisbane, which would act as a natural reservoir for the storage of a large quantity of water in the porous strata, but after passing in review the basins of the rivers above mentioned, I had to admit that I could not call to mind such an area as that I was in search of.

STRADBROKE ISLAND.

In the month of September, 1876, I had occasion to visit Stradbroke Island for the purpose of surveying some land applied for by the Moreton Bay Oyster Company. I was camped on the island for about three weeks, and have pleasant recollections of the little stream of beautifully pure, cool, and constantly-running water, from which we procured our camp supplies. Capembah Creek, the stream I refer to, is marked on the map, and is about two and a-half miles north of Dunwich. The basin of this small but perennial stream was subsequently determined by Mr. H. W. Lethem's survey to be only 600 acres; yet I have not the least doubt that, taking one year with another, the mean discharge from this small basin is equal to one million gallons per day, sufficient to serve a population of 20,000 people at the rate of fifty gallons per head per day.

Whilst I was mentally but futilely passing in review every conceivable source of supply on the mainland, it occurred to me that the natural conditions I was in search of were to be found on Stradbroke Island. Yes, here unquestionably was a sufficient area, and, what is of greater importance, a sufficient mass of absorbent sand to form, with an adequate rainfall, an immense natural reservoir, where water, as pure as nature can distil, is stored in more than sufficient quantity to serve the needs of Brisbane for centuries to come.

DESCRIPTION OF THE ISLAND.

I shall confine my remarks to the available portion of the island north of Swan Bay, extending 22 miles from north to south by a maximum width of 7 miles and a mean width of about $4\frac{3}{4}$ miles. The gross area north of Swan Bay is 67,000 acres, but excluding the fringing swamps and mangrove marshes the area available for water supply purposes is about 51,000 acres.

These, and other particulars which I will give later on, have been taken from the careful survey of the island made in 1902, on behalf of the Brisbane Board of Waterworks, by the late Mr. H. W. Lethem, licensed surveyor, who adopted mean sea-level as the datum of his survey.

The characteristics of the island of the greatest value from the point of view of water supply are: (a) The island is practically a mass of sand of a particularly retentive quality; (b) The number of high hills and ridges, also of sand, extending throughout the length and breadth of the island; and (c) the large mean annual rainfall.

In the month of June, 1900, thanks to the courtesy of my friend, Mr. W. R. North (who has lived on the island for more than twelve years), I had an opportunty of again visiting Stradbroke. Mr. North and I spent two days exploring the island on horseback, during which we traversed fully seventy miles, crossing the island in several directions and visiting Amity Point and Point Lookout, as well as many of the lakes, of which there are at least twenty.

From the mean of forty barometrical observations taken at various salient points on the island, I deduced the mean elevation north of Canaipa as 200 feet. The highest point I attained was the summit of Mount Binbeean, which I made 570 feet; but I observed that several of the adjacent hills appeared to be higher.

Mr. Lethem's survey shows that the highest peak is 720 feet above datum; this hill he named Mount Hardgrave, in honour of the venerable chairman of the Brisbane Board of Waterworks. Another hill, 644 feet above datum, he named Mount Corrie, in honour of Mr. Leslie G. Corrie, Mayor of Brisbane, and at that time an ex officio member of the Board. Mount Vane he made 650 feet; Mount Scott 518 feet; Mount Willes 441 feet; Mount Hutton 418 feet; and South Hill 410 feet.

Of unnamed hills whose heights were determined by Mr. Lethem, there are, between 600 and 700 feet above datum, nine; between 500 and 600 feet, eighteen; between 400 and 500 feet, twenty-one; between 300 and 400 feet, eighteen; and between 200 and 300 feet six.

In his general report on this survey, Mr. Lethem said: "The number of flag stations where the height was calculated is 82, and

the height varied from 135 feet to 720 feet, the mean height being 457 feet. I estimate the mean height of the sand hills and basins at 250 feet."

The island, therefore, may be regarded as an immense mass of sand of irregular shape porous as a sponge, 22 miles in length by a mean width of $4\frac{3}{4}$ miles, of which 51,000 acres has a mean elevation of 250 feet above datum, so that the great elevated mass above high tide level, is equivalent to more than twenty thousand million cube yards available for the absorption and storage of water. It is the mean height of the mass and not merely the superficial area that constitutes the real value of Stradbroke Island as a source of water supply.

If the mean height of the island were only twenty or thirty feet, Stradbroke would not be of any value as a source of water supply to places beyond the island.

It is generally considered by engineers that thoroughly compacted sand will absorb one-third of its bulk of water, but if the quantity stored in the sand at Stradbroke were only one-tenth of the mass, it would exceed fifteen hundred million tons or more than sufficient at the present rate of consumption to serve Brisbane for one hundred and seventy years.

The extent and potential value of the island storage may be better estimated when I mention that entirely neglecting the mean annual rainfall available for absorption—which later, I will show is twenty-five times greater than the present requirements of Brisbane—and taking less than one-third of the possible and probable storage of the past, the fact remains that in the great sand mass of Stradbroke Island there is one and a-half times as much water as is held up by the great dam at Assouan on the Nile, which is said to be more than sufficient for one year's full domestic supply for the United Kingdom.

The highest visible water on Stradbroke is in Swallow Lagoon, 497 feet above datum. The lagoon is only ten chains from the highest point, and yet, with a drainage area of only sixty acres, it did not fail throughout the dryest year in the history of Australia. This conclusively proves that the sand mass is saturated with rain water from sea-level almost to the summits of the highest hills.

The largest volume of visible water is in Lake Karboora (the blacks call this lake B'meeree), whose level is 182 feet above datum. The surface area of the lake is about 75 acres, and the area of the contributing basin, which has no outlet to the sea, and includes the highest hills on the island, is 4,242 acres. The mean elevation of this basin is probably about 400 feet, so that its potential value as a source of water supply is probably double that of any equal superficial area on the island.

From the 21st April, 1902, to the 23rd November following, the level of the water in Lake Karboora only fell $18\frac{3}{4}$ inches in 216 days of the most protracted drought, thus amply and conclusively demonstrating the high degree of saturation and the retentive quality of the sand. Nor is this peculiar to Lake Karboora, for Mr. Lethem gauged the loss by percolation and evaporation from eleven lagoons in various parts of the island, ranging from 25 feet to 497 feet above datum, the mean height of the water in the lagoons being 118.22 feet. The mean loss per 24 hours was found to be .0081 feet or less than one-tenth of an inch per day. Commenting on these details, Mr. Lethem said: "None of these lagoons except Lake Karboora and Blue Lagoon contain any large body of water, but they show the level of water in the surrounding sand hills, which are the true source of supply, and where the water can never be contaminated From these watershed areas and quantities after the long continued drought, we may safely assume 1,000 gallons per acre per day as the minimum flow from the sand hills and basins of Stradbroke Island—rather less than quarter of the average daily rainfall."

Mr. Lethem concluded his report with these words: "I think the survey has emphasised the fact that there is abundance of water of the best quality for a population of at least 500,000 in time of drought."

RAINFALL.

The mean annual rainfall of Stradbroke Island is between 60 and 70 inches, the whole of which would penetrate the sand. Allowing for evaporation, it may safely be assumed that the effective rainfall for storage purposes would average 40 inches on 51,000 acres, equal to more than forty-six thousand million gallons per annum or more than twenty-five times the quantity at present supplied to Brisbane.

In his original report on Stradbroke Island, dated 23rd October 1901, Mr. Foster-Barham said: "Assuming an average annual rainfall of 65 inches, and that 50 per cent. of such rainfall reappears in the form of springs, then it may be noted that the discharge from Stradbroke Island on an area of 109 square miles, and assuming that such discharge was constant throughout the year, would be 142 million gallons daily." By this estimate the mean daily discharge from Stradbroke Island is more than thirty-six times greater than the mean daily quantity of water supplied to Brisbane during the year 1903.

The total rainfall recorded at Dunwich during the year 1902 was 25.53 inches, or less than 40 per cent. of the mean annual rainfall.

Mr. Foster-Barham, in his annual report dated 13th May, 1903, said: "The survey of Stradbroke Island was completed at the end

of last year, and disclosed many interesting features, especially with regard to the high elevation of some of the hills, and the number size, and depth of the numerous lagoons. The exceptional drought experienced last year (1902) has afforded an excellent opportunity of gauging the capacity of the island from a water supply point of view, under conditions which may not occur again for many years. It is satisfactory to be able to state that the opinions expressed in my original report (23rd October, 1901) on this subject, as to the permanence of the supply have been fully realised. The percolation gauge established by the Board shows that practically no water penetrated more than a few feet below the sand surface during the eighteen months ended January 31st last, yet in spite of this fact the daily discharge from what is known as the Blue Lagoon, which drains an area equal to about one-twentieth of the whole island, dropped only from 3,753,000 gallons on September 18th, 1902, to 3,294,000 gallons on January 14th, 1903."

No greater or better evidence of the value of Stradbroke Island as a source of water supply can be given than the fact that at the time when the Brisbane River, with a drainage basin of 4,000 square miles, had ceased to contribute a gallon of water by natural flow,— Blue Lagoon, on Stradbroke Island, with an area of only 3,320 acres, or 0.13 per cent, of the area of the Brisbane River above the pumping station at Mount Crosby, was yielding between three and four million gallons per day by natural flow.

It is evident from the observations of water levels made by Mr. Lethem in 1902, that the most protracted and severe droughts have no appreciable effect on the vast body of water stored in the porous sand hills and basins of Stradbroke Island.

Whatever loss there may be owing to the scanty rainfall of one, two, or even three years in succession, is quickly replenished in such years as 1893 and 1898, the recorded rainfall at Dunwich for those years being 111.00, and 105.24 inches respectively. During such heavy and often continuous rain, the proportion that would be absorbed and stored in the sand is very great, probably not less than 75 per cent., so that when it is borne in mind that each inch of rain water absorbed by the available area of the island (51,000 acres) exceeds eleven hundred million gallons, equal to eight months supply for Brisbane at the present rate, it will be seen how quickly any loss by percolation or evaporation is made good.

Having shown from the results of actual survey conducted during the dryest year on record, by a most competent and trustworthy officer, whose untimely death caused by exposure whilst in the execution of this survey, I regard as a loss to the community, that Stradbroke Island north of Swan Bay is a vast natural reservoir and a source of supply which any city in Australia might well be proud

of, the next questions are: Can the water be brought to Brisbane, and, if so, at what cost?

Can Stradbroke water be made available? The distance of the main land from that portion of the island available as a source of water supply, varies considerably. Amity Point, at the north-western extremity, is 16 miles from the mouth of the Brisbane River; Dunwich is 7½ miles from Cleveland; but if the aqueduct were carried across Peel Island the extent of water to be crossed would be reduced to 5½ miles. The length of aqueduct required from Lake Karboora to Highgate Hill reservoir via Peel Island and Cleveland, would not exceed 30 miles. On this route, Mount Petrie, which, according to the map, has an elevation of 550 feet, would afford a suitable site for the pipe-head reservoir.

The southern end of the available area is, however, only about 2½ miles from the main land at the mouth of the Logan River; but as Russell Island lies betwen, the actual width of salt water to cross is limited to two narrow channels, one between Stradbroke and Russell Islands, which may be taken as from 440 yards to 570 yards according to the crossing selected; and the other between Russell Island and the main land is about 1,650 yards in width. The minimum width of salt water to cross, therefore, is about 2,090 yards. These channels are not deep; the greatest depth in the narrower channel is 23 feet; it could be bridged at a height sufficient to allow the ordinary sailing craft of the Bay to pass under. The wider channel has a maximum depth for a short distance only, of 30 feet; it could be crossed by bridging or preferably, I think, by means, chiefly, of a narrow causeway constructed of rubble stone, of which, I understand, a fair supply could be obtained on Russell Island.

Other methods of conveying the water from Stradbroke to the main land would be by pipes laid in a trench under water, or by tunnels.

Mr. Lethem, unfortunately, did not complete the alternative surveys for the pipe line from Stradbroke to Highgate Hill reservoir, South Brisbane; but from a memorandum he sent me on the 22nd August, 1903, I learn that the approximate distances, which he thought were within half a mile one way or the other, are as follow:—

	Miles
1. Eighteen-mile Lagoon via Mount Scott, Rocky Point, Logan River, and Mount Cotton.	33
2. Blue Lagoon via Canaipa, Pannikin Island and Mount Cotton.	39½
3. Lake Karboora via Canaipa, Pannikin Island and Mount Cotton	41

		Miles.
4.	Blue Lagoon via Canaipa, Rocky Point, Logan River, and Mount Cotton.	$43\frac{1}{2}$
5.	Lake Karboora via Canaipa, Rocky Point, Logan River, and Mount Cotton.	45

Mount Cotton, Mr. Lethem stated, is 17 miles from Highgate Hill Reservoir

Although a large quantity of water is available at the southern end of the Eighteen-mile Lagoon, where it discharges into Swan Bay, and the pipe line from this point to South Brisbane is estimated by Mr. Lethem at only 33 miles,—I regard the high country in the neighbourhood of Lake Karboora as the best source of supply, so that, in the estimate, I have prepared for the purposes of this paper, I have allowed for the maximum length of aqueduct, namely, 45 miles. I have no information about Mr. Lethem's route No. 3, via Pannikin Island; but if the estuary crossings by this route are not too difficult, it would save four miles of main aqueduct.

As Lake Karboora is 182 feet above mean sea-level, the water having no outlet to the sea, whilst the watershed on the western side is comparatively low, it might, I think, be practicable to convey the water from this basin by means of a syphon, over or through the divide, from whence it would flow by gravitation to the main land.

In my estimate, I have provided for a pumping station on the main land as near to Mount Cotton as may be practicable, the water to be forced by a rising main to a reservoir situated on the slopes of the Mount at a height of about 400 feet. From thence the water would flow by gravitation in a 30-inch main to Highgate Hill and other service reservoirs in the neighbourhood of the city. My estimate provides for a first supply of between six and seven million gallons per day. The quantity of water supplied to the city and suburbs by the Brisbane Board of Waterworks during the year 1903, averaged 3,873,212 gallons per day; so that a 30-inch pipe from Stradbroke would probably suffice for the next fifteen or twenty years.

WHAT WILL THE SCHEME COST?

Mr. Foster-Barham, in his original report on the island, dated 23rd October, 1901, written before the survey was commenced, said:

"Any estimate for the carrying out of such a scheme at so preliminary a stage, must necessarily be very approximate. No prices for material have been obtained, and in the heaviest item—that of the steel pipes for the aqueduct—may easily upset any estimate by £50,000, according to the current price at which such pipes could be obtained. However, to give some idea, I have taken out a rough estimate on such data as are at hand, and from this, and my know-

ledge of the cost of this class of work, I do not think such a scheme could be carried out under £800,000, and possibly it might run to £900,000."

Mr. Foster-Barham provided for a 36-inch steel main, 48 miles in length, to deliver ten million gallons per day, an amount evidently far in excess of the requirements of Brisbane for many years to come; in fact, Mr. Foster-Barham, in his first general report to the Brisbane Board of Waterworks, dated 17th July, 1901, stated, that if the population continued to increase as rapidly during the next fifty years as during the previous twenty years, which, by the way, is not probable, then the water requirements of Brisbane in 1951 would be 14,500,000 gallons per day; and, I may add, that on the same basis, a service of 10,000,000 gallons per day would not be required before the year 1930.

It is a matter for regret that Mr. Foster-Barham had not an opportunity of preparing a revised estimate for the Stradbroke scheme after the completion of Mr. Lethem's survey.

The principal item of expense as Mr. Foster-Barham pointed out, is the pipe or aqueduct, the cost of which would vary according to the pressure to be resisted and the material used. With so low a head as less than 200 feet for that portion of the aqueduct between Lake Karboora and the pumping station on the main land, it is possible that a wooden pipe would answer, the cost of which should not exceed £2,000 per mile. Wooden pipes have been used in the United States to serve larger cities than Brisbane, and have proved successful and durable, under moderate heads of from 200 to 250 feet.

For a 30-inch pipe on the Monier system to withstand a head of 200 feet, laid and jointed, but exclusive of excavation, I have a quotation from the local agents, Messrs. Finlayson Brothers, of £3,760 per mile.

From the pumping station the rising main to Mount Cotton should be either steel or cast iron; but the gravitation main might be constructed partly in wood or in Monier concrte, and the lower parts, subject to the greatest pressure, in steel or cast iron.

In my estimate, however, I have provided for a 30-inch steel main throughout.

Two storage reservoirs would be required, both of which would be on the main land, one at the pumping station to receive water delivered by gravitation from Stradbroke Island, the other, or pipe-head reservoir, on a spur of Mount Cotton. From the latter, the service reservoirs in the vicinity of Brisbane would be supplied by gravitation.

The total cost of the scheme by the estimate I have prepared for this paper, is £526,830; but the cost might be reduced by about

17 per cent., if a wooden aqueduct were used for pressures not exceeding 100 lbs. per square inch. This would be practicable, I think, for about two-thirds of the main aqueduct.

In an article I contributed to the "Telegraph" of the 12th May, 1900, I pointed out the advantages afforded by Stradbroke Island as a source of water supply for Brisbane, and stated that the total cost of works, pumps, pipes, estuary crossings, reservoirs, buildings, etc., for a supply of five million gallons per day, probably would not exceed £500,000. At that time, twenty-four years had elapsed since I had had an opportunity of inspecting any portion of the island, and no detail surveys were at that time available.

It is often instructive to compare the estimated cost of engineering works in contemplation with the actual cost of similar but completed works of the same class. The goldfields water supply scheme of Western Australia, now happily consummated, owing to the genius, foresight, and courage of the Honorable Sir John Forrest, P.C., K.C.M.G., although of much greater magnitude and difficulty than the project under review, may be cited as a case in point. This great scheme involved the following works:—

1. A branch railway to the Helena River for the purpose of transporting materials, etc.
2. A large concrete dam at the Helena River, capable of holding up four thousand million gallons.
3. 328 miles of 30-inch steel pipe of the locking-bar type.
4. Six separate pumping stations with their necessary adjuncts in the way of storage reservoirs, pumps, boilers, buildings, quarters for engineers, firemen, etc.
5. A large service reservoir for purposes of distribution at the goldfields.

The net maximum lift from the storage reservoir in the Helena River to the main distributing reservoir at the goldfields is 1,290 feet, the mean rise per mile of main pipe being 3.933 feet. Allowing for loss of head at the pumping stations and the friction in 328 miles of pipe, the actual work involved is estimated as equivalent to a head of 2,655 feet, which, multiplied by the weight of water delivered per day (25,000 tons), gives the total work per day as 66,375,000 foot tons. The engines have 6,187 horse-power, of which 40 per cent. is kept in reserve.

Exclusive of reticulation, the completed works cost, in round figures, £2,700,000, equal to £8,232 per mile of main aqueduct, the principal item being the 30-inch steel pipe.

My estimate for the Stradbroke Island scheme including a 30-inch steel pipe 45 miles in length, and only one pumping station, amounts to £11,707 per mile, or 42 per cent. more than the actual

cost of the West Australian works. If a wooden pipe were used for two-thirds of the distance, as, I believe, is practicable, the cost per mile would be about £9,703, and the total cost about £436.630.

CONCLUDING REMARKS.

Stradbroke Island yields a pure, cool, and soft water of uniform quality that will never require filtration, because the sand in which it is stored is, in itself, a natural filter.

It is impossible to state the money value to any community of an adequate supply of soft water of uniform quality; but no city can attain the first rank in manufactures and commercial industry that is dependent upon inferior water of variable quality.

With the excellent supply of cheap coal that is now available, and the healthy climate of Southern Queensland, I know of no factor so likely to lead to the prosperity of Brisbane, and the rapid increase of its population as an ample supply of pure, cool, and soft water of uniform quality suitable for any manufacturing or industrial purpose. Such a supply can only be procured from Stradbroke Island.

In passing, I may mention that Moreton Island as well as Fraser's or Great Sandy Island are also natural reservoirs that contain vast supplies of water; but neither of those islands are available for the supply of Brisbane. Fraser Island, however, may yet prove a perfect mine of wealth as the means of providing irrigation water for the main land in the neighbourhood of Maryborough.

Unlike the Brisbane River source, Stradbroke Island cannot be affected by either flood or drought, for its waters are not rendered turbid by the former, nor scanty and polluted by the latter.

Towards the end of September, 1901, the island was visited, and to some extent inspected by the following members and officers of the Brisbane Board of Waterworks, namely: the chairman, Mr. John Hardgrave, Mr. Arthur Midson and the writer; also, Mr. H. G. Foster-Barham, A.M., Inst. C.E., engineer, and Mr. George Johnston, secretary. The outcome of that official visit was the report by the engineer, dated 23rd October, 1901, and the survey subsequently made for the Board by Mr. H. W. Lethem.

On the 13th January, 1903, at the invitation of the Board, a number of gentlemen including His Excellency Sir Herbert Chermside, G.C.M.G., C.B.; Honorable J. F. G. Foxton, Home Secretary; Honorable A. J. Thynne, M.L.C.; Honorable Dr. Taylor, M.L.C.; medical officer for the city of Brisbane; Mr. J. T. Bell, M.L.A.; Mr. J. Currie, Mayor of South Brisbane; Mr. A. B. Brady, Under-Secretary for Public Works; Dr. Ham, Commissioner for Public Health; Mr. C. J. Pound, Government Bacteriologist; Mr. J. B. Henderson, Government Analyist; Mr. Alexander Corrie, and others, including several representatives of the Press, left Brisbane

by the Government steamer "Lucinda," and spent two days riding about the island, visiting the various lakes and points of interest, inspecting the estuary crossings. etc. The Board on that occasion was represented by the chairman, Mr. John Hardgrave, and the Mayor of Brisbane, Mr. Leslie G. Corrie. Unfortunately, owing to a sudden illness, and much to my regret, I was unable to leave home; whilst two other members of the board, Mr. L. A. Bernays, C.M.G., and Mr. Arthur Midson, were also unable to attend. The party was accompanied by the following officers of the Board, namely: Mr. George Johnston, secretary; Mr. H. G. Foster-Barham, engineer; and Mr. H. W. Lethem, surveyor.

His Excellency, when returning thanks on that occasion for the toast of his health proposed by the chairman, said:

"He thanked their host, Mr. John Hardgrave, for the delightful trip he had given them, also for giving them an opportunity of inspecting the basis of such an important project as the supplying of the best possible water to Brisbane. Whether it would be a matter that would be realised in the lifetime of the chairman, or whether the scheme were put off to some future time, more or less remote, there was no denying that a splendid and pure supply was obtainable on the island."

The experience of 1902 has demonstrated beyond question the necessity of either extending our present sources of supply or of seeking for a new one. Either course must involve a large, and, for a pure supply, probably a not very disproportionate expenditure, so that the time is opportune to fully consider and weigh the merits of the island scheme before a large expenditure on the present sources, puts Stradbroke water beyond the reach of the present generation.

OBJECTIONS TO THE SCHEME.

The principal objections that have been urged against the scheme are as follows:—

(a) Cost.

(b) Risk of interruption in time of war.

(c) That Stradbroke Island may gradually break up and disappear.

I have shown elsewhere in this paper that money and plenty of it must be expended before Brisbane can enjoy the advantages of a good supply of pure water, and this quite irrespective of Stradbroke. In fact, I am of opinion that it would prove less costly to go to Stradbroke than to attempt to adequately improve the present sources of supply, whilst there can be no comparison as regards the uniform quality of the water to be obtained by either method, as the water from Stradbroke is pre-eminently pure and uniform in quality.

As regards the second objection, namely, "Risk of interruption in time of war." I may point out that one hundred and seventeen years have elapsed since the British first occupied the Australian continent. During that period, although Great Britain has been at war with the greatest naval powers, no vessel of war representing a hostile nation has appeared on the Australian coast, nor, failing the establishment by some rival Power of a strong naval base in the Pacific, is such a contingency likely to arise? Taking the most unfavourable view, however, and assuming that the commander of a hostile cruiser, after successfully evading the British squadron in Australian waters, had the opportunity and thought it worth while to cut off the water supply from Stradbroke Island, we should, in that event, fall back on the present sources of supply, which would of course, be retained. In this connection, I may point out that whilst an enemy might temporarily interrupt the water supply from Stradbroke Island, he could not destroy the source; whereas, if the enemy were strong enough to land, he might destroy the reservoirs at Enoggera and Gold Creek, or similar reservoirs that may yet be constructed, and effectually interrupt the supply from Mount Crosby.

I now come to the third objection—that Stradbroke Island may gradually break up and disappear.

No one who knows the physical characteristics of the island would raise this objection which has been largely based in the breach of recent years at Jumpin Pin, where the sea broke across the low and narrow strip of sand which formed the connecting link between the northern and southern portions of the island. Probably, this is not the first time that such a breach has occurred at this place; but in any case, it is of no importance, as Stradbroke Island south of Swan Bay is too narrow and too low to be of any practical value as a source of water supply for Brisbane.

In his general report, the surveyor, Mr. H. W. Lethem, said: "The Eighteen-mile Swamp is separated from the sea by a line of sand dunes, with flats behind them; the average height of the sand dunes may be take as 40 feet above mean sea-level, and as is to be expected they are subject to change in form and position by strong winds, chiefly south-easterly; but I could find no evidence that the sea ever washes over them into the swamp behind, which is as high above sea-level as many islands of the Pacific."

Mr. Foster-Barham, in his report, dated 23rd October, 1901, dealt at some length with the question of the stability and permanence of the island, and, whilst he expressed the opinion that the sea was encroaching in the neighbourhood of Swan Bay, he did not hesitate to recommend the island as a cource of water supply, in the following words: "It is evident, from what has been written, that there is an abundance of pure stored water on Stradbroke Island,

ready filtered, uninfluenced by floods, of a cool temperature, and only requiring the means of collecting and transmitting it for the use of Brisbane."

In a letter published in the Brisbane "Courier" of 21st February, 1903, Mr. W. R. North, an old resident of Stradbroke, said: "When reading the account of the Brisbane Board of Waterworks' meeting last Monday, I noticed the engineer to your Board advises that cross sections of the eastern coast on Stradbroke Island should be taken to find out if the sea is gaining on the island. Now, I have lived here for over ten years, and can assure the Board that from Point Lookout to Swan Bay the island is, and has been, making up. I have several fences running down to the sea, and I have to be continually raising them, or they would be covered up. One fence near Swan Bay was two years ago 5 feet out of the ground, and is quite covered now. There is a bank from 20 feet to 40 feet high from Point Lookout to Swan Bay, and this is continually on the rise. I know of many places where the sea is from 500 to 600 yards further back from the banks than it was some years ago. The island certainly cut away at Swan Bay and Amity Point, where the land was very low, but has not gone any more of late years. As an instance that the islands are making up, take the telegraph line across Moreton Island, the old wooden poles being out of sight now, and the Telegraph Department had to drive iron piles in the water to prevent the line sanding up."

Considering that the mean height of the island north of Swan Bay is 250 feet, and that the mean height of all Mr. Lethem's flag stations, 32 in number, is 457 feet, I think that any doubt as to the stability and permanence of Stradbroke Island as a source of water supply for the city of Brisbane may be dismissed as groundless.

SOME NOTES ON PALESTINIAN ARCHAEOLOGY.*

By WILLIAM P. F. DORPH, M.R.A.S.

Hon. Secretary for N.S.W., Palestine Exploration Fund.

I DESIRE to premise my remarks by stating that the term "Archæology" is used to denote the study of the material as opposed to the literary documents, which have come down to us, and it is regarded as "the science of the treatment of the material remains of the human past." And it is only within the latter part of the nineteenth century that general action has been taken to preserve for national purposes, the chief findings of those who grope among the ruins of the past. The purpose of Archæology is to disclose the life and mind of the ages that have passed away. To this end, it is needful that the most complete collections of everything discovered should be placed in the museums, where they may be studied. Before giving an account of what has been excavated in Palestine, it will be best to begin, by saying, what a "Tell" is. Scattered all over the ancient lands of the East are thousands of artificial mounds; in the plains of Egypt they strike the traveller's attention, rising abruptly to 50 or even 80 feet above the level alluvium; in Palestine they are less obtrusive, owing to the hilly aspect of the country, but go where you will, these artificial "tells" are to be seen in every view. It may be asked how it is that such remains are not found in the West. The reason is twofold; firstly, that our civilisation is not old enough to have produced them; secondly, our buildings are of much less destructible material than those of the drier lands of the East (as they have to resist bad weather), and hence they decay less quickly. But yet we have our "tells," only we still live upon the top of them. As a "tell" is being examined, we at once recognise the fact, the existence of a pile of cities, representing so many civilisations that have risen and fallen one after another. So difficult has it always been for people to imagine the existence of such piles of cities, the second built on the ruins of the first, the third on the ruins of the second, and so on, to the number of perhaps a dozen, that, after Dr. Schliemann's books had been before the people for years, with their description of the seven superimposed cities of Troy, he felt it necessary as late as 1890 to invite a representation of *savants* of different nations, who testified that he had found there a vertical series of

* Read at the Royal Geographical Society of Australasia, Queensland, June 27, 1905.

cities, truly inhabited at successive periods and not a mound used in different ages for cremation.

Let me now give some account of what excavation work has been accomplished at Tell-es-Sâfi, which was one of the cities in the Shephelah. The term Shephelah is used in the Talmud to mean the low hills of soft limestone, which form a distinct district between the plain and the watershed mountains. The Vale of Elah, coming westward through the low hills of the Shephelah, sweeps around its north side, and at once enters the Philistine Plain. Tell-es-Sâfi thus stands as a natural fortress between this plain and the rolling country. The view is magnificent. Tell-es-Sâfi is described by Townsend MacCoun, M.A. (Mem. Amer. Hist. Assoc.; Fell. Amer. Geog. Soc.) in his "Holy Land," vol. I, p. 17, thus: "As Gezer stood at the northern extremities of the Shephelah, commanding the Valley of Ajalon, so is the western edge marked in the centre by Tell-es-Sâfi (*shining hill*), a cliff 300 feet high, connected with the ridge on the south by a narrow saddle. A position of immense natural strength, one well-nigh impregnable when protected by fortifications, it guards the mouth of the Valley of Elah. and on it in 1144 was built the crusading fortress of Blanche Garde." Then to the north appears the town of Ramleh, with its tower; to the east is the olive-dotted Shephelah, bounded by the Judean Mountains, and crossed by the lower ridge, running from Tell-ej-Judeideh to Tell-Zakarîya; to the west lie the sites of Ashod and Ascalon quite distinct. The Wely (Arabic—tomb of a Moslem saint) dedicated to the Khûdr, stands in the highest part of the Tell, i.e., the south end, 300 feet above the well in the river bed. From the river bed the ground slopes up gradually to the base of cliffs of white limestone, in others, covered with weeds, which rise to a great height. From the top of the cliffs the ground rises rapidly to the Wely. The ground near the graveyard surrounding the Wely is irregular and broken up by rubbish heaps. The lofty south end must always have been the Acropolis. The mounds of rubbish represent the ruins of the crusading fortress of Blanche Garde as an outpost of defence during the war with the people of Ascalon. It fell into the hands of Saladin in 1187.

In his book, published in 1872,* G. Key gives a sketch plan of the remains of this fortress. According to him, the building was about 60 metres square. In 1875, Dr. Conder, LL.D., R.E., D.C.L., M.R.A.S., found the Wely, but says: "of this fortress, nothing remains but the rock-scarps which are dimly traceable."† After describing the geographical and historical portions of the Tell, we

* "Etudes sur les Monumento de l'Architecture Militarre les Croisés en Syrie et dans l'jle de Chypre," par G. Keys, Paris.

† "Tent work in Palestine," p. 276.

now come to some of the archæological results acquired by Dr. Bliss, Explorer to the Palestine Exploration Fund. The first task was to make trial pits to determine the nature and depth of the accumulation. Three were sunk in a line east and west along the eastern half of the square available on the summit south of the village. In the shaft nearest the eastern slope, rock was found at a depth of 41 feet, in the others, at 30 feet and 24 feet 6 inches respectively. For the first five feet Arab pottery occurred; below this for five feet or more, the ware was of Jewish type. Thence to the rock the fragments were pre-Israelite in character, growing more ancient as we descended, so we find four strata of pottery existed. From the surface to a depth of five to seven feet we find a good proportion of Arab-glazed ware, sometimes rudely marked with patterns. The other types include the Jewish form, found at Tell Zakarîya (with the exception of the lamps with thick bases), a good deal of early Greek ware (B.C. 700-550), some specimens of Greek black and red ware (B.C. 550-350), and a few pre-Israelite types. In this stratum were found the foundations of a series of rudely-constructed chambers, built in mortar, as well as several fallen voussoirs. The dressed stones all showed signs of the fine diagonal Crusading chiselling. The ware used by the Crusaders was doubtless the local Arab. The four strata may be briefly described thus:—

1. A pre-Israelite stratum on the rock, older than the lowest stratum at Tell Zakarîya.
2. A later pre-Israelite stratum.
3. A stratum contemporaneous with the Jewish period, and extending into Greek times.
4. A Crusading stratum.

Thus, according to the testimony of the pottery, the place appears to have had a continuous history from the 18th to the 14th century B.C., when it appears to have been abandoned till the period of the Crusaders.

The objects found were of stone, bronze, iron, and paste. In *stone*: uninscribed weights, catapult balls, a lamp-stand, slate spindle-whorls, beads, a small rudely incised cylinder, corn-rubbers, etc. In *bronze*: three coins, spatulas, pins, arrow-heads, fragments of vessels, etc. In *iron*: bolts, pins, arrow-heads, spear-heads, fragment of knives, a sickle, etc. Hardly any iron was found more than 14 feet below the surface. In *paste*: many beads, two scarabs, one scaraboid (Babylonian ?), representing a man on horseback, attacking a lion, and three Egyptian amulets—one in the form of an ape, the second, a lion-headed figure, the third, perhaps a Bes. One Crusading coin of silver was also found near the surface.

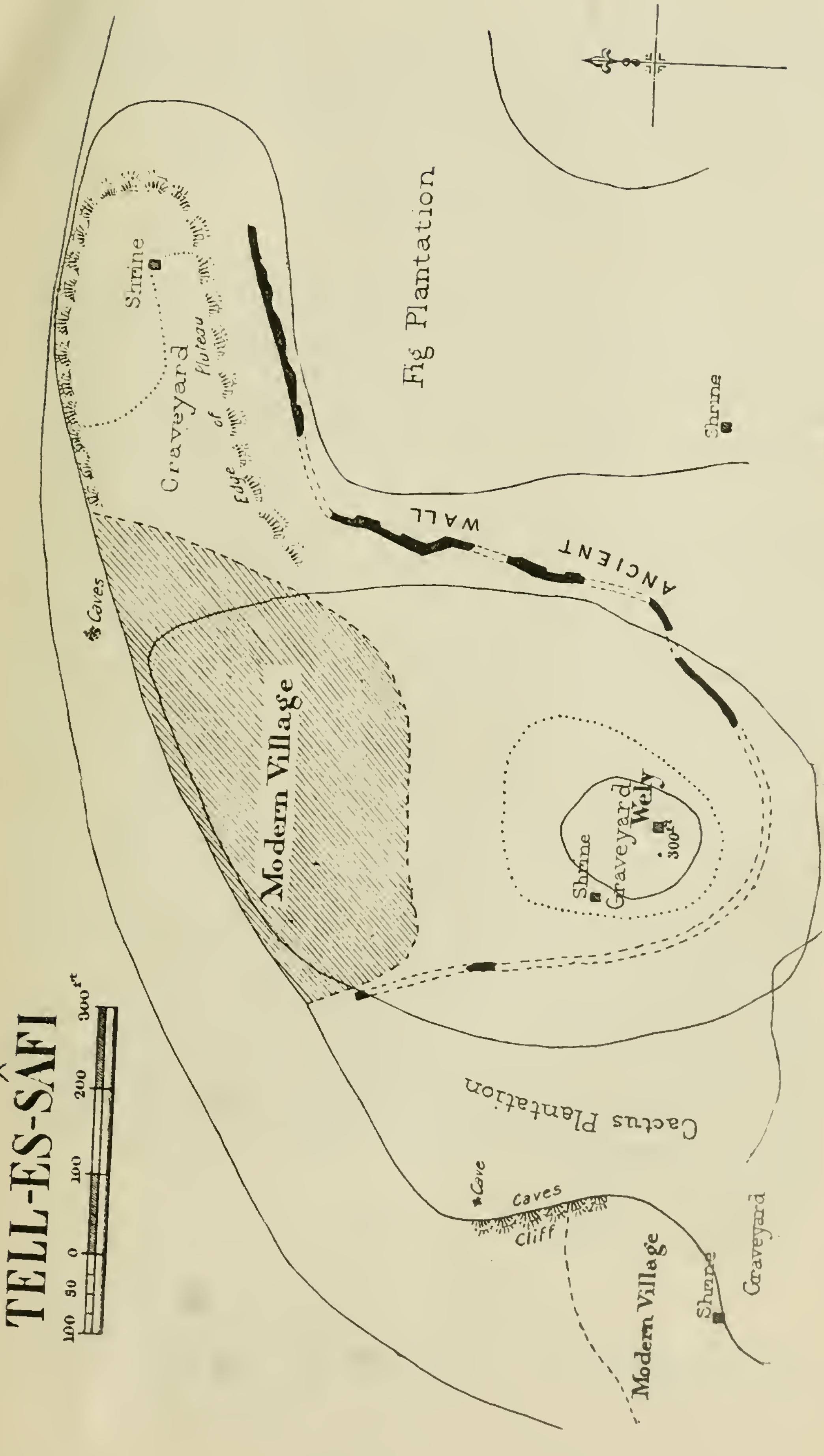
I will now describe the city wall of Tell-es-Sâfi. Long sections were laid bare by excavations. At the points tested it was found to

rest on from 6 to 11 feet of *debris*. It was seen at two points to be 12 feet thick, and consists of external and internal facings of rubble, with a filling of earth and field stones. The face stones are laid in mud, mixed with straw. Projecting from the wall at intervals ranging from 28 feet to 35 feet 9 inches, are buttresses, ranging in length of face from 30 feet to 34 feet. The maximum projection is only 2 feet. The masonry consists of rudely-spaced rubble set in courses ranging in height from 1 foot 3 inches to 2 feet. The stones are roughly squared, except at coigns of the buttresses, where the work is much better. The interstices are fitted with sand and small field stones. The masonry is mainly plain-faced, though two or three drafted stones occur. In places, the wall has been plastered with dark mud and straw, over which is a layer of white mud, mixed with straw, made by mixing a powder of unburned limestone with water. This kind of plaster is used in the Lebanon to-day. Immediately to the south of the Wely, there are traces of mud-brick, reduced by conflagration to burned brick, cropping out from the surface. In front of the wall, and along its ruined top was found a strange mixture of objects, of which now only a general summary can be given: pottery ranging from early pre-Israelite to late Greek times, including a stamped jar handle, with two lines of Hebrew writing; busts, and other fragments of statuettes in limestone; fragments of face-masks in pottery; figurines in pottery in great variety, including one which appears to be Pan; Egyptian amulets; beads in great quantities; a Babylonian scaraboid; fragment of a Ushabti figure, with hieroglyph inscription, etc.

A mine, suggesting such possibilities of discovery deserved working, two gangs of competent men have been tracing its limits, passing every basketful of earth through sieves, north and south it extends over a length of about 35 feet. The stamp on the jar handle just referred to, is in the form of a rude circle, 1.25 centimetres in diameter, with two lines of Hebrew writing, separated, as in the case of well-known Hebrew seals, by two parallel bars. In stamping, an unequal pressure was used, hence the right upper corner is not plain. Four letters appear clearly in the upper line with traces of another, probably a *lamed*, at the right. The top of the next letter is incomplete, but it is probably a *resh*. The only possible alternatives would be a late form of *tsade*, as found in examples of Maccabean times, and a form of *samech*, found in the Siloam inscription.*

Now, the question may be asked, "What light have these investigations thrown on the identification of Tell-es-Sâfi with Gath?"

* *Lamed* is the 12th Hebrew letter, *resh* the 20th Hebrew letter, *tsade* the 18th Hebrew letter, and *samech* the 15th Hebrew letter.


TELL-ES-SÂFI
100 50 0 100 200 300 ft
Shrine
Graveyard
Edge of Plateau
Fig Plantation
Shrine
ANCIENT WALL
Caves
Modern Village
Shrine
Graveyard
Wely
300 ft
Cactus Plantation
Cave
Caves
Cliff
Modern Village
Shrine
Graveyard

This identification was originally advanced purely on the grounds of the importance and position of the site, no determination having been made of its antiquity. However, in 1890, Dr. Petrie made a brief examination of the surface pottery, and found pre-Israelite types. Our work has amply confirmed his observations. We have proved the existence of a city, built in pre-Israelite times, and probably fortified during the Jewish period. Gath was in existence at the time of Joshua's conquest (Josh. xi., 23), and was fortified by Rehoboam (2 Chr., xi., 8).

In conclusion, I would like to make a few remarks on the cup-marks associated with the rock-cut apparatus for pressing wine, olives, etc., which was found in the rock-cuttings of Tell-es-Sâfi. These cup-marks are of two classes—deep circular bowls, generally speaking in the shape of a half melon cut across the long axis, and shallow saucers. The practice of making cup-marks in rocks is of great antiquity in Palestine. The purpose of these cup-marks is obscure, although two explanations have been brought forward. These are: First, that they were used for watering cattle; and second, that they were intended as small olive-presses, for obtaining a limited quantity of oil required for immediate use. That some such utilitarian purpose was intended in many cases seems most probable. Large cups, 3 feet 8 inches across by 2 feet deep are the dimensions of one at Tell-es-Sâfi, are found near cisterns, and may well be intended for the use of cattle. Moreover, many groups are found in the neighbourhood of places which, in all probability, have always been olive plantations. Cup-marks have also been found at Tell-Zakarîya and El-Mediyeh. The one at Tell Zakarîya, being 10 inches in diameter and $9\frac{1}{2}$ inches deep, was cut in the rock surface. The *debris* that had accumulated about it, contains early types of pre-Israelite pottery. The fact, at least, admits the possibility of the cups being the work of a race, which, in the occupation of Palestine, preceded the tribes so often enumerated in the Pentateuch. Again, these cup-marks have been found at the old Levitical city of Gezer, these being 1 foot 6 inches across, and 1 foot 4 inches deep. In this instance, Professor J. L. Paton, the present Director of the American School of Archæology at Jerusalem, suggests, that in some way, the cup-marks were connected with the religious rites of the Neolithic troglodytes of Gezer.

ETHNOLOGICAL NOTES ON THE ABORIGINAL TRIBES OF QUEENSLAND.*

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INTRODUCTORY.

In this short treatise it is contemplated to furnish some original information respecting the sociology and languages of some tribes in the south-west district of Queensland, and also in the north-west of that State. It may be well to briefly point out to the reader the connection beween the present work and former contributions on this subject .

In Volume XVIII. of this Journal, I submitted a grammar of the Murawarri language. In the same year, 1902,[1] I published a grammar and vocabulary of the Yualeai language, spoken on the Balonne and Moonie Rivers. This was accompanied by a grammar of the Pikumbil dialect, in use among the natives of the Weir and Macintyre Rivers. In 1904 I prepared a grammar and vocabulary of the Kogai language, spoken on the Balonne, Maranoa, and Coogoon Rivers.[2] The Baddyeri language now submitted is the fifth Queensland tongue, of which I have published the grammar.

A short reference to adjoining tribes will be of interest. The Wonkamurra Nation, treated in this article, is adjoined on the west by what I have elsewhere described as the Parnkalla Nation, whose social divisions are Kirraroo and Matturri. On the south of the Wonkamurra is what I have called the Barkunjee Nation,[3] in which the two intermarrying divisions are Keelparra and Mukwarra.

Adjoining the Wonkamurra on the east is the Baddyeri, described in these pages, with the social divisions Woongo, Koobaroo, Bunburri, and Koorgilla. Various other tribes using these same four section names, but whose dialects are more or less diverse, extend all the way northerly as far as Cloncurry and Camooweal, and thence to Halifax Bay on the coast. This organisation has much the largest

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* Read at the Royal Geographical Society of Australasia, Queensland, June 27, 1905.

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[1] Journ. Roy. Soc. N.S. Wales, vol. xxxvi., pp. 135-190.

[2] Zeitschrift für Ethnologie, vol. xxxvi., pp. 28-38.

[3] Group Divisions and Initiation Ceremonies of the Barkunjee Tribes, Journ. Roy. Soc. N.S. Wales, xxxii., 241-250, with map.

geographic range of any in Queensland. The approximate boundaries of the territory over which such tribes are scattered, are described in an article[1] contributed by me in 1898, to the American Philosophical Society at Philadelphia, U.S.A.

In the district about Yelvertoft, near Camooweal, and for some distance to the eastward, the organisation containing the *four* sections, Woongo, Koobaroo, etc., meets the system in which there are the *eight* sections of the Inchalachee (or Inchalanchee), and Workaia community. The several examples of sociology described in the following pages are, therefore, representative of that existing among all the native tribes from the New South Wales boundary to Nicholson River in Queensland, a distance of about 900 miles in a direct line.

When two aboriginal tribes adjoin each other, although their sectional divisions may have entirely different names, yet if a man in one of these tribes wishes to obtain a wife from the other, there are certain inter-tribal laws by which he knows the proper woman to enquire for. When a certain section in one tribe holds the same place in the social system as a section in another tribe, these sections are said to correspond, or be equivalent, to each other. Thus, in the following table, the section Koolpirro in the Wonkamurra tribe is said to be equivalent to Keelparra in the Barkunjee tribe, or to Kirraroo in the Parnkalla, or to the pair of sections, Wunggo and Kupuru in the Baddyeri tribe. In other words these sections are the equivalents of each other. For example, if a man of the Koolpirro section were to go and settle in Barkunjee country, he would take his position in the Keelparra section; if he went to reside with the Parkalla[2] people he would rank in the Kirraroo section; and if he were to cast in his lot with the Baddyeri tribe he would become a Wuttheru. The matter of whether he should be called a Wunggo or a Kupuru would be determined by the old men:—

Wonkamurra	Barkunjee	Parnkalla	Baddyeri	
Koolpirro	Keelparra	Kirraroo	Wuttheru	{ Wunggo Kupuru
Thinnĕwa	Mukwarra	Matturri	Yunggo	{ Bunburri Kurgila

With regard to the sociology of the Inchalachee tribe in the north-west of Queensland, and their congeners in the Northern Territory, I have found it a difficult matter to separate the eight sections into two phratries. In the present treatise, I have adopted a different arrangement of the sections in each phratry to any hitherto

[1] Proc. Amer. Philos. Soc., vol. xxxvii., pp. 331-332, with map.

[2] "Divisions of the S.A. Aborigines," Proc. Amer. Philos. Soc., vol. xxxix., pp. 79-83, with map.

published. My information regarding the eight-section system has been obtained with the aid of reliable correspondents residing in that part of the country. The whole of the sociology and language of the Baddyeri, Murawarri, Yualeai, Pikumbil, and Kogai tribes was gathered by myself in the camps of the natives.

SOCIOLOGY OF THE WONKAMURRA TRIBE.

In the south-west corner of Queensland, where the 29th parallel of latitude meets the South Australian boundary, there are some small tribes whose social organisation consists of two exogamous groups, called Koolpirro and Thinnewa, which intermarry one with another in conformity with prescribed laws. The following are the most important of these tribes.

The Wonkamurra tribe is located on the Warry-Warry Creek and Lower Wilson River, reaching up the Cooper till met by the Mullinchi people. It also extends southerly into New South Wales, as far as Milparinka. Easterly of the Wonkamurra is the Kullalli, on the Bullo Downs; and north of the latter is the Bunthamurra tribe.

On the west of the Wonkamurra are the Yanderawantha and Yowerawarrika tribes, situated within the State of South Australia. Their social divisions are the same as those of the Wonkamurra, and were first discovered and reported by me in 1899,[1] and again in 1900,[2] together with maps showing their geographic limits. Previous to the dates just mentioned, the divisions Koolpirro and Thinnewa were altogether unknown in Australian literature.

The rules of intermarriage among the Wonkamurra and kindred tribes can be concisely represented in tabular form.

TABLE I.

Phratry.	Husband.	Wife.	Offspring.
A	Koolpirro	Thinnéwa	Thinnéwa
B	Thinnéwa	Koolpirro	Koolpirro

The following are some of the totems of the Koolpirra people: carpet snake, red ochre, crow, kite-hawk, rainbow, pig-face, emu, pituri, small rat, native companion, curlew, rain, bull-frog, bandicoot.

The Thinnewa division claims the undermentioned animals and objects amongst others: iguana, jew lizard, witchetty, water rat, eaglehawk, shag, dingo, native cat, kangaroo rat, plain turkey, black duck, plover, crane, diver.

The Wonkamurra, Kullalli, Bunthamurra, Yanderawantha, and Yowerawarrika may be termed a community, or nation, which we shall distinguish as the Wonkamurra Nation. They not only have

[1] Journ Roy. Soc. N.S. Wales, vol. xxxiii., p. 108.

[2] Proc. Amer. Philos. Soc., vol. xxxix., pp. 83-84, and 562-563, with maps.

the same names for the two intermarrying divisions, but they speak dialects of the same language.

According to Table I, Koolpirro and Thinnewa intermarry one with the other, but this is subject to certain regulations. Take for example, a Koolpirro man and his sister; then, the man's son's child marries his sister's son's child. In this case, which is the normal custom, a Koolpirro marries a Thinnewa, as in the table. In some instances, however, the man's son's child mates with his sister's daughter's child, which gives the exceptional custom of a Koolpirro marrying a Koolpirro. In all cases, without exception, the child takes the phratry and totem names of its mother. That is, if the mother be a Thinnewa of the Plover totem, her children will be Thinnewas and Plovers, whether she marry a Koolpirro or Thinnewa husband.

SOCIOLOGY OF THE MURAWARRI TRIBE.

In an article contributed to this Journal in 1902, I supplied a grammar and vocabulary of the Murrawarri language.[1] This tribe occupies an extensive region in the southern frontier of Queensland, between the Warrego and Culgoa Rivers, reaching also some distance into New South Wales. On the present occasion, I shall describe the social divisions and intermarrying regulations prevailing among these people.

The social structure of the Murawarri community comprises two exogamous divisions, which we may call phratries or groups, or any other name by which they can be readily distinguished. These two divisions are named Girrana and Merugulli. Girrana is subdivided into two sections called Kubbi and Murri; and Merugulli is similarly divided into Ippai and Kumbo. The following table exhibits how these sections intermarry, and the sections to which the progeny belong:—

Table II.

Phratry.	Husband.	Wife.	Son.	Daughter.
Girrana	Murri	Butha	Ippai	Ippatha
	Kubbi	Ippatha	Kumbo	Butha
Merugulli	Kumbo	Matha	Kubbi	Kubbitha
	Ippai	Kubbitha	Murri	Matha

Besides the partition of the community into phratries and sections as above explained, there is a further subdivision of the people into lesser groups, which bear the names of different animals, plants, or inanimate objects, which are called *widdyi* in the Murawarri tongue—a word signifying "totem."

Again, each phratry, and the sections of which it is composed, possess a further distinctive division into Muggulu and Mumbirra,

1. Vol. xviii., pp. 52-68.

meaning sluggish blood and swift blood, respectively. These may, for convenience of reference, be called "blood divisions."

There is still another repartition of the community, which can be distinguished as "shade divisions." For example, when a few friendly families, or a party of hunters, are resting under the shade of a tree, the people who belong to the Muggulu "blood division" sit down in the *dunggu*, or shadow thrown by the butt or lower portion of the tree. The Bumbirra people sit down to rest in the *dhurbun*, or shadow cast by the higher branches of the tree—the outside edge of the shade.

Let us take an example from Table II. A man of the Girrana phratry and Murri section, marries a Muggulu woman of the Butha section. The children follow the Merugulli phratry the same as their mother, but they do not bear the name of her section. They are Ippais and Ippathas, being the supplementary section of their mother's phratry. (See Table.) The progeny, boys and girls alike, inherit their mother's totem; thus, if she be a kangaroo, they will be kangaroos too.

The castes or divisions of "blood" and "shade" must be taken into account in arranging the betrothals and marriages, and also in tracing the pedigree of the progeny. A man of the Muggulu "blood," and the Dunggu "shade," marries a Bumbirra woman of the Dhurbuñ "shade." In regard to the offspring, a Muggulu mother produces Muggulu children, who take their mother's shade, Dunggu. A Bumbirra mother produces Bumbirra children belonging to the Dhurbuñ shade.

The castes of "blood" and "shade" are not necessarily coincident with the other divisions. For example, a Bumbirra man or woman may belong to either phratry or to any section; and a Merugulli individual has the same scope.

Although the four sections of the Murawarri have the same names as those of the Ngeumba and Wailwan, who adjoin them on the south and south-east, the individual sections do not correspond one with the other, as will appear by the following table:—

TABLE III.

Murawarri.			Ngeumba.	
Girrana	Murri Kubbi	is equal to	Ngurrawan	Ippai. Kumbo
Merugulli	Kumbo Ippai	is equal to	Mümbun	Kubbi Murri

This may be illustrated by supposing a Murawarri man of the Murri section settles among the Ngeumba people, he ranks as an Ippai, and so on, as in the above table.

The mother of a youth and the mother of his betrothed wife call each other *bumbun*. The youth and the maid reciprocally call

each other *gundin*. A girl's brother calls her betrothed husband *girrin*. A mother-in-law is called *gundi-gundi*; a son-in-law, *gurru-wallan*; and a mother's brother, *guddhi*.

The phratries, sections, totems, and castes of blood and shade above described are used in tracing out the pedigree of the parties to a matrimonial alliance. Upon this foundation, the actual marriages are regulated by a system of betrothals, which are made after a child is born, and not infrequently before that event. For example. they wish to determine what woman is the proper wife for a boy, A. The old men know who is the father of A. whom we may designate B. From this they find C, the father of B, or A's grandfather in the paternal line. Next, they discuss who was a sister of C, whom we shall denominate D. Then. a daughter of one of D's children will be the correct wife for A.

That is, a brother's son's child mates with a sister's son's child. This is the "direct" rule of marriage; for example, Murri marries Butha, as in Table II. But if C's son's child be allotted a spouse who is D's daughter's child, this constitutes the marriage which may be tentatively distinguished as "indirect," or Murri marries Matha, and the offspring are Kubbi and Kubbitha.

In making the betrothals the old men endeavour, as far as the pedigrees will admit, to arrange that the brothers and sisters of certain families shall intermarry with the brothers and sisters in certain neighbouring families, whether in the same or in an adjoining tribe. This has the effect of binding the two intermarrying families together by ties of kinship. and thereby strengthening their claims to consideration in the tribal councils. It also adds to their joint importance at the great gatherings which take place for initiatory ceremonies, barter and other purposes.

Perhaps it should be stated that I was the first author to discover and report the castes of "blood" and "shade" in the sociology of any Australian tribe. See my "Sociology of the Ngeumba Tribe," Journ. Roy. Soc., N.S. Wales, vol. XXXVIII., p.p. 207-217.

SOCIOLOGY OF THE BADDYERI TRIBE.

On the north-west of the Murawarri is the Baddyeri tribe, whose hunting grounds extend from about Yantabulla to Hungerford, Eulo, Thargomindah, and intervening country.

The community is segregated into two primary divisions called Wuttheru and Yunggo. The former is again divided into two sections called Wunggo and Kupuru, and the latter into two, called Bunburri and Kurgila. The following table shows the normal intermarriages of the sections, and also to what section the resulting progeny belong. The feminine of each section name is formed by the suffix *gan*:—

TABLE IV.

Phratry.	Husband.	Wife.	Son.	Daughter.
Wuttheru	Wunggo	Bunburrigan	Kurgila	Kurgilagan
	Kupuru	Kurgilagan	Bunburri	Bunburrigan
Yunggo	Bunburri	Wunggogan	Kupuru	Kupurugan
	Kurgila	Kupurugan	Wunggo	Wunggogan

In addition to the above divisions, every man, woman, and child in the community bears the name of some animal, plant, or natural object, as his or her totem.

A man marries his father's father's sister's son's daughter for the "direct" marriage, or, in other words, Wunggo mates with Bunburrigan as in the above table. But it is also lawful for a man to espouse his father's father's sister's daughter's daughter for the "indirect" alliance; that is, Wunggo marries Wunggogan. In short, all that has been said in preceding pages respecting the intermarriages of the Murawarri sections, and the divisions into "shade" and "blood" castes, applies to the Baddyeri, and need not be repeated. The rules of marriage and descent are precisely the same in both tribes, but the names of the partitions and repartitions are entirely different.

GRAMMAR OF THE BADDYERI LANGUAGE.

SPELLING.

The system of orthoëpy adopted is that recommended by the Royal Geographical Society, London, but a few additional rules of spelling have been introduced by me, to meet the requirements of the Australian pronunciation.

Eighteen letters of the English alphabet are sounded, comprising thirteen consonants, namely: *b, d, g, h, k, l, m, n, p, r, t, w, y*, and five vowels: *a, e, i, o, u*.

As far as possible, vowels are unmarked, but in some instances, to prevent ambiguity, the *long* sound of *ä, ë, ï, ö* and *ü* are given as here represented. Where the *short* sound of those vowels was otherwise doubtful, they are marked thus: *â, ê, ô*, and *û*.

It is frequently difficult to distinguish between the short sound of *a* and that of *u*. A thick sound of *i* is occasionally met with, which closely resembles the short sound of *u* or *a*.

B has an intermediate pronunciation between its proper sonant sound and the surd sound of *p*. The two letters are practically interchangeable.

G is hard in all cases, and often has the sound of *k*, with which it is generally interchangable.

W always commences a syllable or word, and has its ordnary English sound. The sound of *wh* in our word "what" has no equivalent in the native tongue.

Ng at the beginning of a word or syllable has a peculiar nasal sound as in the English word "singer." If we alter the syllabification of this word and write it "si-nger," then the *ng* of "-nger" will represent the aboriginal sound. Or if we take the expression "hang up" and change it into "ha-ngup," and then pronounce it so that the two syllables melt into each other, the *ng* of "-ngup" will also be the sound required. At the end of a syllable, *ng* has the sound of *ng* in king.

The sound of the Spanish ñ frequently occurs. At the beginning of a word or syllable it is given as *ny*, but when terminating a word the Spanish letter ñ is used.

Dh is pronounced nearly as *th* in "that," with a slight sound of *d* preceding it. *Nh* has likewise nearly the sound of *th* in that, with a perceptible initial sound of the *n*.

Th is frequently used at the commencement of a word instead of *dh*, and in such cases an initial *t* sound is substituted for that of the *d*. *Dh* and *th* are generally interchangeable. At the beginning of a word our English sound of *d* and *t* seldom occurs; it is generally pronounced *dh* or *th*, in the way just explained.

A final *h* is guttural, resembling *ch* in the German word "joch."

Y at the commencement of a word or syllable preserves its habitual sound.

R in general has a whirring sound, at other times it is rolled, and occasionally the English value is assigned to it.

T is interchangeable with *d*, *p* with *b*, and *g* with *k*, in most of the words in which these letters are used.

Ty or *dy* at the commencement of a syllable or word has nearly the sound of the English *j* or Spanish *ch*, thus with *tya* in the word ngul-tya, closely resembles *cha* or *ja*.

Some native words terminate with *ty*, as 'Kui-gaty,' one of the frogs. The last syllable of this word can be pronounced exactly by assuming *e* to be added to *y*, making it -gat-ye. Then commence articulating the word, including the *y*, but stopping short without sounding the added *e*. An accurate pronunciation can also be readily obtained by substituting *ch* for the *y*, making it gatch, but omitting the final hissing sound when pronouncing it.

Where double *l* occurs, it often closely resembles *dl*; thus *thallu*, straight, could be spelt *thadlu*. The same thing happens with double *n*; thus, the word *wunna*, a boomerang, could be pronounced *wudna*.

In several native words, an indistinct sound of *r* seems to come before some consonants. Thus, it is difficult to distinguish between *ngurl-pa* and *ngul-pa*. In modifying the terminations of words for inflection or declension, *r* is often changed to *l*.

Articles.

The indefinite article, *a*, is not represented, but the demonstrative pronouns, in their numerous modifications, supply the place of the definite article, as "this man," "that woman," "yonder hill." The English adverb, "here," in its several native forms, is frequently treated as a demonstrative, and is then also a substitute for the definite article.

Nouns.

Nouns are subject to variations, on account of number, gender, and case.

Number.—There are the singular, dual, and plural numbers, which are declined by postfixes: thus, gula, a kangaroo; gulabula, a pair of kangaroos; guladhudna, several or many kangaroos.

Gender.—Sex in the human family is distinguished by different words: as, kurna, a man; gurukara, a woman.

For the lower animals the gender is indicated by the addition of a word signifying "male" or "female," as: gula thuladya, a buck kangaroo; gula ngummaga, a doe kangaroo. The ordinary native terms for "father" and "mother" are equally employed for the same purpose.

Case.—The cases are indicated by inflexions, the following being the principal:

The Nominative indicates anything at rest, and is without flexion, as: mirri, a dog; wunna, a boomerang.

Causative: This is used for any action described in a transitive verb, as: gulalu ngunnha murntai-inna, a kangaroo me caught (a kangaroo caught me; mirrilu gurokin that-thai-inna, a dog an opossum bit.

The Instrumental case takes the same suffix as the Causative, as: kurnalu gula wirrai-inna wunnalu, a man a kangaroo hit with a boomerang.

Genitive: Kurnagu wunna, a man's boomerang; gurokingu birndu, an oppossum's tail; gurukaragû gunburra (or dharulu), a woman's yamstick.

Dative: Guguburra nguntyoa dhikkingu, come to my camp; yukuna ngunnungullaki barranggadhani, he is coming towards me.

Ablative: Nguntyimunni dhikkinmunni bararne, go away from the camp; yukuna nguntyamunni barrawanne, he is going away from me.

The Accusative is generally without flexion.

Adjectives.

Adjectives are placed after the nouns they qualify, and are similarly declined for number and case. They are compared by making two positive statements, as: Nurndin yukula, this is good; wutthan nyunna, that is bad.

PRONOUNS.

Pronouns have number, person, and case, and contain two forms in the first person of the dual and plural numbers, one of which includes the person addressed and the other excludes him.

In the singular number there is a set of nominative pronouns to be used with transitive verbs,[1] and another set for use with intransitive verbs, as in the following table:

			Transitive.	Intransitive.
Singular	1st Person,	I	Nguttha	Ngunyi
	2nd ,,	thou	Yuntu	Yinni
	3rd ,,	he	Nyalu	Guninna

In the dual and plural, the pronouns are the same whether employed with transitive or intransitive verbs. The double form of "We" is distinguished by being marked "inclusive" or "exclusive" in the following list:

Dual, 1st Person	We, inclusive	Ngulli
	We, exclusive	Nyangulli
Plural, 1st Person	We, inclusive	Ngunna
	We, exclusive[2]	Nyangunna

Examples of the second and third persons are omitted.

In the possessive and objective cases of pronouns, there are forms for all persons and numbers. There are likewise forms of the pronouns meaning "with me," "towards me," "away from me," and so on.

Interrogatives: Where (singular), ngumbilla? Where (dual), ngumbillabula? Where (plural), ngumbilladhunna? How many, ngundhapo? Who, wurrana? Whose, wurranguna? Who (did it), wurralu? What, minna? What for, minnatyu.

Demonstratives: The demonstratives in this language, by the combination of simple root-words, can be made to indicate position, distance, direction, number, person, movement, etc. Only a few examples will be given at present:

This, yukuna. That, nyunna. That only, nyuntuna. That (did it), nyalu. Those (dual), nyabula. That (other one), gundhunna. This (only), yukunawira. That (yonder), gumbarri. Belonging to that one, nyundaua. That on the left, gummaraki. That on the right, thattyaniki.

Many of the demonstratives are likewise used as pronouns of the third person, which explains the great number, irregularity, and

[1] See my "Native Dialects of Victoria," Journ. Roy. Soc. N.S. Wales, vol. xxxvii., pp. 243-253.

[2] I was the first author to report the double form in the first person of the dual and plural, in any of the aboriginal languages of Queensland. "The Murawarri Language," Queensland Geographical Journal, vol. xviii., pp. 52-68.

lack of etymological connection observed among such pronouns in the numerous aboriginal languages whose grammars I have promulgated.

Relative pronouns have no place in this language.

VERBS.

Verbs have the singular, dual, and plural numbers, with the usual tenses and moods. There is a form of the verb for each tense, which remains practically constant through all the persons and numbers. Any required person and number can be expressed by using the proper pronoun from the table above given.

The following is a short conjugation of the verb "ngurlpana," to beat:

Indicative Mood.

Present, I beat	Nguttha	Ngurlpanana
Past, I did beat	Nguttha	Ngurlpanginana
Future, I shall beat	Nguttha	Ngurlpangunna

Imperative Mood.

Beat		Ngurlpana

Conditional Mood.

Perhaps I shall beat. Ngutthu wulla ngurlpangunna.

Reflexive Mood.

The reflexive form of the verb is that which describes an action which the subject executes directly upon himself:

I am beating myself. Ngunyi ngurlpanganiwaninyi.

Reciprocal Mood.

This modification of the verb applies itself to a case where two or more persons reciprocally beat each other, and is consequently limited to the dual and the plural.

There are also modifications of the verbal suffixes of the past tense to indicate the immediate past, the recent past, and the remote past. Similar modifications exist for the proximate, or more or less distant future. There are, moreover, forms of the verb to express repetition or continuance of the act described, and many other complexities, which need not be detailed in the present brief paper.

There is no special form for the passive voice. For example, the statement, "A boy was punished by his father," is expressed by the paraphrase, "The father punished his son."

ADVERBS.

The following are a few of the more commonly used verbs:—

Yes, ngawau. No, yana. Here, nyunulli. There, gunilla. Over there, guninne. Now, miuli. To-day, miyu. Yesterday, yinta. To-morrow, bardawira. Yonder, gumbarri. By-and-by, burrauira. A little while ago, mintyu. Some time ago, muttya. Perhaps, waingera. Where, ngumbilla? How many, ngundhapo?

Prepositions.

In front, kunning-kunning. Behind, thurula. Away in the rear, kumburra-gundhala. Inside, kittya. Outside, dhurnaki. Beside or at the side of, ukuwallakurra. Between, murañ. This side of, nyau-allakurra. Down, barrula. The other side of, murlaki. Northward, garrabo. Southward, wurtulla. Eastward, ngurraba. Westward, ganañ.

Numerals.

One, kurritya. Two, bulunna. Three (two and one), bulukurrittyerri. Five, or a hand, murrawurgan. Ten, or both hands, murrakullañ.

Vocabulary.

The following vocabulary, containing about 320 of the most important words in general use by the Baddyeri tribes, has been prepared from my own notes. Everyword was carefully written down by myself from the lips of the native speakers, in their own camps.

The Family.

A man, Kurna.
Old man, Dhulaia.
Clever man, Kubi-ila.
Master, Nguddhing.
Married man, Ginnila.
Young man, Wilynarru.
Youth, Burlu.
Father, Wanyuko.
Father-in-law, Dharruna.
Elder brother, murnu.
Younger brother, Ngulaika.
Woman, Gurukkara.
Old woman, Murguñ.
Wife, Noara.
Girl at puberty, Kumañ.
Girl (small), Nai.
Mother, Ngurndaka.
Mother-in-law, Kuliri.
Elder sister, Thadhunna.
Younger sister,
Mother's sister, Bubbakunna.
Mother's brother, Kutthekulla.
Father's brother, Pulkamulli.
Orphan, Thibbarañ.

The Human Body.

Head, Girli.
Forehead, Ngulu.
Hair of head, Girli-bukki.
Beard, Ngurnkuru.
Eye, Mainyu.
Eyebrow, Milbirri.
Nose, Minti.
Jaw, Wukkara.
Back of neck, Burti.
Throat, Wurri.
Ear, Yuri
Mouth, Thunga
Lips, Nimmi.
Finger-nail, Binguñ.
Calf of Leg, Malya.
Shin, Warta.
Thigh, Dhurra.
Knee, Muku.
Foot, Dhinna.
Heel, Ngurnu.
Sinew of heel, Gurañ.
Toes, Bikkañ.
Penis, Gurni.
Scrotum, Gurlu.
Erection, Dhungurni.
Emission, Ngurrami.

The Human Body—*Continued.*

Tongue, Tharlang.
Teeth, Tia.
Chin, Ngarnmu.
Chest, Murna.
Navel, Nimbiñ.
Stomach, Minta.
Rump, Butu.
Hip joint, Birlkin.
Anus, Ngupin.
Flank, Ngunni.
Back, Dharna.
Woman's breasts, Ngumma.
Shoulder, Kurta.
Upper arm, Marnku.
Forearm, Kalya.
Elbow, Kupu.
Hand, Marra.
Semen, Nguru *or* burtiñ.
Copulation, Nanyarnanni.
Masturbation, Burrapurra.
Vagina, Yuli.
Labia majora, Bimbarra.
Labia minora, Thattyi.
Clitoris, Wakkana.
After-birth, Wurrañ.
Urine, Kurlpa.
Venereal, Mika.
Excrement, Guna.
Intestines, Ngurli.
Blood, Gumarn.
Fat, Wurntu.
Skin, Yulain.
Bone of animal, Birna.
Skin of animal, Kulkañ.

Inanimate Nature.

Sun, Yuku.
Moon, Pattyuka.
Stars, Burli.
Shooting star, Gunkina.
Orion's Belt, Burnkutya.
Pleiades, Gambalbirri.
Gentle winds, Yertu.
Sky, Ngai-iri.
Clouds, Dhaïngurra.
Thunder, Buruku.
Lightning, Mirndaru.
Rain, Burtu.
Dew, Ippañ.
Fog, Guguma.
Rainbow, Gutiga.
Dust-storm, Pulperu.
Frost, Girndimurra.
Hail, Mukurri.
Water, Nguppa.
Waterhole, Burru.
Lake, Milka.
Mirage, Birtarru.
The ground, Marnli.
Mud, Dhurna.
Stones, Barri.
Fire, Wi.
Smoke, Burntu.
Day, Dippilla.
Night, Gurntalla.
Morning, Burrai.
Evening, Karriñ.
Food (flesh), Witthi.
Food (vegetable), Munnu.
Honey, Gudya.
Hill, Bagu.
Creek or gully, Wirra.
Grass, Butthu.
Trees, Wugga.
Bark of trees, Pirriñ.
Leaves of trees, Dhirra.
Wood, Wugga.
Camp, Dhikkiñ.
Hut, Gurli.
Hole, Wirli.
Egg, Kuppuñ.
Pathway, Dhinna.
Shadow of man, Thittha.
Shade, Wurntañ.
Pipeclay, Kupa.
Picture, Mulka.

INANIMATE NATURE—*Continued.*

Sand, Thiddhuru.
Sand-hill, Munggala.
Scrubby place, Marpa.
Open plain, Yarra.
Light, Battyu.
Darkness, Gurntalla.
Heat, Waddyañ.
Coldness, Mukkuru.
Red ochre, Gia.
Echo, Ngaialla.
A sore, Mika.
A boil, Butthuru.
Charcoal, Gurniñ.
Ashes, Burlityi.
Live coal, Pattyu.

MAMMALS.

Kangaroo, Gula.
Porcupine, Thantyin.
Wild dog, Wilkañ.
Opossum, Gurokkañ.
Bandicoot, Burkañ.
Native cat, Burbur.
Wallaby, Morriñ.
Bat, Bintalliñ.

BIRDS.

Emu, Gulburri.
Eaglehawk, Gurrawurra.
Crow, Wakan.
Black duck, Mingurra.
Teal duck, Kultaba.
Wood duck, Gurnali.
Pelican, Birrai.
Laughing jackass, Gagunguru.
Native companion, Kunthara.
White cockatoo, Kakkana.
Black cockatoo, Kerki.
Swan, Kuturu.
Birds collectively, Yurli.
Common magpie, Gulpo.
Slate crane, Windyulettyau.
White crane, Bulumpulu.
Spoonbill, Murrinpindarra.
Plain turkey, Dyikkara.
Plover, Kalthaltharri.
Curlew, Wirlungurra.
Quail, Dhunañ.
Brown hawk, Gurka.
Shag, Dharruguru.
Willy-wagtail, Dyirritba.

FISHES.

Fish generally, Kwia.
Bream, Wirrinkala.
Bony fish, Bandya.
Yellow-belly, Kupirri.
Cat-fish, Warli.
Murray cod, Burntu.

REPTILES.

Tree iguana, Wanggo.
Sand iguana, Barna.
Jew lizard, ganni.
Snakes generally, Yutha.
Shingleback, Mutun.
Creamy snake, Mintyagaina.
Mulga snake, Bumburra.
Carpet snake, Gurimurra.
Sleepy lizard, Gubin.
Turtle, Birderi.
Green Frog, Ngubarn.
Tiger snake, Wurrungan.
Whip snake, Guguru.
Jumping frog, Bailku.
Small frog, Purranpan.

Invertebrates.

Bee, Thirti.
Locust, Thirrintyan.
Centipede, Dhilyeri.
Louse, Ngurtu.
Nits of lice, Kulka.
Jumper ant, Thumba-thumba.
Common fly, Muguñ.
Spider, Karra.
Mosquito, Thui.
Bulldog ant, Galtalta.
Common ant, Gadu.
Greenhead ant, Murnuñ.
March fly, Binpirri.
Sandfly, Gunti.
Crayfish, Bugilli.
Crabs, Murnyirrin.

Trees and Plants.

Kurrajong, Yerragan.
Ti-tree, Kungkiñ.
Grey box, Gandungurra.
Mulga, Mulka.
Blood-wood, Biddhagarran.
Wild willow, Dyilkara.
Beef-wood, Thankka.
White-wood, Purpan.
Pine, Piliñ.
Giddyea, Guburdu.
Hop-bush, Ngurtika.
Gum tree, Kagula.
Myall, Kurlku.
Wild orange, Dhangurra.
Iron-wood, Guyuru.
Needle-wood, Burnda.
Brigalow, Dhundharra.
Leopard-wood, Gireñ.
Swamp yam, Nandhuru.

Weapons and Effects.

Hunting spear, Yanggo.
Jagged spear, Milla.
Shield, Burgo.
Fighting club, Muru.
Hunting club, Kutyero.
Boomerang, Wunna.
Tomahawk, Dhurrañ.
Koolamin, Pikkurrañ.
Circumcising knife, Kango.
Stone or shell knife, Wukkana.
Yamstick, Kunburra.
Net bag, Kurlka.

Adjectives.

Large, Murra.
Small, Munyi.
Long, Dhauaru.
Short, Ngunta.
Good, Nurndin.
Bad, Wuttañ.
Hungry, Burokara.
Thirsty, Ngadyarañ.
Distant, Kumbari.
Near, Birtinya.
Red, Thirte.
White, Kupa.
Black, Karakara.
Full, Girre.
A few, Bulagattyera.
Plenty, Thuntalu.
None, Munggaru.
Courageous, Wullakarpa.
Afraid, Karapa.
Sweet, Thaddyi.
Angry, Thirri-burntana.
Right, Ngulurli.
Wrong, Watthaya.
Straight, Thallu.
Crooked, Wurri-wurri.
Tired, Murnthallin.
Greedy, Wulle-yikkana.
Silent, Nguppo.

ADJECTIVES—*Continued.*

Empty, Murta-murta.
Quick, Yannangarra.
Slow, Muta.
Blind, Burnko.
Jealous, Gurniñ.
Flat, Bullarin.
Round, Karluñ.
Square, Thauaru.
Sick, Murkin.
Lame, Munna munna.
Deaf, Bunko-bunko.
Strong, Thadni.
Weak, Kantya.
Heavy, Murukana.
Light, Minyupuliñ.
Many, Murulu.
Stupid, Purra-purra.
Ripe, Nurndinya.
Blunt, Watthañ.
Sharp (edge), Thalankuru.
Sharp (point), Dyappa-dyappa.
Fat man, Wurntuila.
Lean man, Watthan-billa.
Hot, Wadyan.
Cold, Mukkuro.
Clear, Nurndiñ.
Dirty, Watthañ.
Glad, Nguluri.
Sorry, Wanki-irranya.
Deep, Kittya.
Shallow, Banda-banda.

VERBS.

Live, Ninnunnakai.
Die, Buka.
Eat, Thalle.
Drink, Binthani.
Sleep, Bugarañ.
Sit, Ninnana.
Go, Barranne.
Tell, Munkki.
Speak, Yanne.
Walk, Barrane.
Run, Birre.
Bring, Wugubutti.
Take, Muka.
Lift, Thinkirrippi.
Carry, Kanggannhu.
Make, Manana.
Break, Kangana.
Strike, Ngurlpana.
Fall, Thirriki.
Observe, Ngaukunna.
Hear, Burrana.
Know, Dhiangana.
Think, Yuriburnta.
Grow, Dhaianni.
Give, Yikkina.
Sing, Muruingulpan.
Fear, Kurrapa.
Frighten, Kurbathana.
Hang up, Gudhamunna.
Hold (anything), Murntana.
Shake, Thillana.
Spread, Ñudyubana.
Stand, Thirna.
Suck, Thuntyana.
Swim, Yungara.
Rub, Thuranna.
Spit, Ngultya.
Pretend, Barliñ.
Paint (one's self), Kumpi.
Play, Wamirni.
Beg, Wuntyana.
Jump, Gulapara.
Keep, Ninnarina.
Kick, Ninpana.
Kiss, Munumpana.
Laugh, Kinta.
Leave off, Wannana.
Scratch, Mirrana.
Tear (with claw), Nulkana.
Lose, Warnbiddhana.
Perspire, Thatthi.
Pinch, Pitthana.

VERBS—*Continued.*

Weep, Wanki.
Cook, Kimpa.
Marry, Ninnarinna.
Sneeze, Thundyurkiñ.
Cough, Kunkuru.
Steal, Paddyetha.
Burn, Thambi.
Ask, Manana.
Barter, Ikkinna.
Bind, Thuntana.
Bite, Thatthana.
Blow (as wind), Bumbinna.
Build, Wilpinna.
Pick up, Mukana.
Put down, Kamunna.
Catch, Murntana.
Climb, Kuttha.
Cover, Numpana.
Drop (from hand), Dhirgithana.
Praise, Yukana.
Be quiet, Wirraninna.
Forget, Walladhianga.
Rend, Nulkana.
Return, Wugo-gillanpana.
Rise, Thingirri.
See, Ngankana.
Search for, Birndana.
Shine, Thainbalinna.
Taste, Thallina.
Turn away, Gillanpi.
Twist, Gillanpana.
Wash, Gulanganni.
Smell, Buddhana.
Throw, Wirranna.
Pitch or heave, Garrana.
Hunt, Barrali.
Lie (down), Wukkanani.

SOCIOLOGY OF THE INCHALACHEE OR INCHALANCHEE TRIBE.

On the sources of the Gregory and Nicholson Rivers, on Barklay's Tableland, Yelvertoft, Rocklands, Camooweal, and extending into the Northern Territory, are the hunting grounds of the Inchalachee, Warkaia and other tribes, possessing eight divisions in their social structure.

In December, 1898, I read a paper before the Royal Society of New South Wales, in which I published, for the first time, the names of the eight sections of the Inchalanchee and kindred tribes, and illustrated the laws of intermarriage and descent of the progeny by means of a table, to which the reader is referred.[1] In the middle of the following year, I read another paper before that Society, respecting the divisions of the native tribes in the same region.[2] My information, in both instances, was obtained through trustworthy correspondents who resided in the locality.

With the continued help of the same capable and reliable friends, who worked under my directions, I have gathered further details in regard to the intermarriages of the several sections, which render the preparation of a new table necessary:—

[1] Journ Roy. Soc. N.S. Wales, vol. xxxii, pp. 251-252.

[2] *Op. cit.*, vol. xxxiii, p. 111.

TABLE V.

Phratry.	Husband.	Wife.	Son.	Daughter.
A	Bolangu	Nungalama	Bulyarinjee	Nulyarama
	Narabalanjee	Nuralama	Bongarinjee	Nongaraima
	Burralanjee	Neonama	Kameranjee	Nemurama
	Kungulla	Nolangma	Yakamurri	Yakamarina
B	Kameranjee	Nulyarama	Burralanjee	Nuralama
	Yakamurri	Nongaraima	Kungulla	Nungalama
	Bongarinjee	Yakamarina	Narabalanjee	Neonama
	Bulyarinjee	Nemurama	Bolangu	Nolangma

The above table gives the phratry, husband, wife, son and daughter, on the same line across the page. For example, Bolangu marries Nungalama, who is his "direct" or normal wife, and may, for convenience of reference, be distinguished as "No. 1." But he could instead wed a Nuralama, whom I shall call "No. 2." Or he could mate with a Neonama woman as "No. 3." And lastly, he might espouse a Nolangma, who can be designated "No. 4."

Marriages of the "No. 1" type, which are those set down in the table, are the most usual; "No. 2" is the next alliance most in favour; whilst "No. 3" and "No. 4" are more or less uncommon, although quite in accordance with aboriginal law. The order of priority here assigned to Nos. 2, 3, and 4 is merely tentative, to serve the purpose of reference. After much correspondence and sifting the particulars collected, I am led to believe that, in some districts, a "No. 4" wife is quite as popular as a "No. 2," or even more so.

In the Inchalanchee and Workaia tribes and their congeners, the section to which the children belong is invariably determined through the mother. For example, if Bolangu wed a Nungalama, as in the table, his children will be Bulyarinjee and Nulyarama; if he take a Nuralama, they will be Bongarinjee and Nongaraima. If he be united to a Neonama his offspring will be Kameranjee and Nemurama; and if his wife be a Nolangma, then his family will consist of Yakamurri and Yakamariña.

In a similar manner Narabalanjee could marry Nuralama, or Nungalama, or Nolangma, or Neonama. The same principle would apply to Buralanjee and Kungulla. It appears, then, that any specific man in Phratry A could marry any one of the four women, Nungalama, Nuralama, Neonama, or Nolangma. Everything which has been said respecting the marriages and descents in Phratry A, applies equally to those in Phratry B.

All the people—men, women, and children—have totemic names, consisting of animals, plants, and inanimate natural objects, but there is no well-defined or invariable descent of any given totem from the parents to their offspring. Indeed, there could not be any regularly established succession of the totems, either patriarchal or

matriarchal, in a tribe where the intermarrying laws are as stated in the foregoing table.

For example, if we postulate that descent is reckoned through the men, and that the crane is the totem of Bolangu, who has three brothers claiming the same bird. One brother marries Nungalama and transmits his totem to Bulyarinjee. Anoher brother takes a Nuralama and his totem descends to Bongarinjee. A third brother weds Neonama, and confers his totem upon Kameranjee. The remaining brother is allotted a Nolangma as his wife, and imparts his totem to Yakamurri.

In the next generation, Bulyarinjee, Bongarinjee, Kameranjee, and Yakamurri would re-transmit the crane totem to the other four sections. It would be possible, therefore, that any and every totem could in this manner meander through every one of the entire eight sections, and consequently there could not be any totemic partition of the tribe into two phratries.

Again, if we assume that succession of the totems is through the women, and work out an example from Table V, we are confronted by a similar difficulty. That is, if the phratries be arranged as now shown in that table.

In order to test this deduction, I collected the totems of several men and women in certain different sections for three generations, with the result that in some cases the totems follow the father—in others, the mother—whilst in others the children inherit the totem of neither parent. In other journals, I have published lists of the totems of the fathers and mothers, husbands and wives, and the progeny for the three generations referred to.[1]

I was the first author to discover and publish the marriages herein described as "No. 3" and "No. 4" respectively, and, with the exception of Rev. L. Schultze, I was also the first to report the "alternative"[2] law of marriage, or "No. 2." But, although polygamy is practised, a man is not allowed to marry into more than one of the four sections, over which he might have marital rights. If more than one wife be allotted to a man, they generally all come from the same lineage as the first one, if there be any other women available in that direction.

Being desirous of discovering any irregularities in this custom, I requested one of my best correspondents to make special enquiries respecting cases where certain known blackfellows had more than one wife. In two instances, a man had two wives, both from the same section. Another man had a "No. 1" and a "No. 2" wife. In

[1] Queensland Geog. Journ. (1901), vol. xvi., pp. 85-86.

[2] American Anthropologist, vol. ii , N.S., p. 495.

another instance, the man had taken a "No. 3" wife first, and his second was a "No 1." I am making further investigation into this matter.

At the ceremonial gatherings of the tribes for initiatory purposes, or for increasing the supply of food animals and plants, or for producing rain, or at any similar ceremonies, when any sexual liberty is permitted, it is for the most part restricted to the four sections of men and women in a phratry. Thus, if a Nungalama woman be the subject of the intercourse, the men who partake of her favours are either Bolangu, Narabalanjee, Burralanjee, or Kungulla. There are, however, exceptions. This was confirmed by actual observation by one of my correspondents at my request.

SOCIOLOGY OF TRIBES IN CENTRAL AUSTRALIA.

Before concluding my description of the eight-section system, it has been thought desirable to make a few further remarks upon that organisation among several large tribes in the Northern Territory.

During the years 1898 to 1901, both inclusive, I contributed to various journals, reports on the sociology of a large number of important tribes in Central Australia. In the latter year, 1901, I brought before the notice of the Royal Geographical Society at Brisbane, the eight-section system of the Neening and neighbouring tribes, who occupy an extensive tract of country in the Northern Territory, adjacent to the boundary of Western Australia, and reaching from Sturt Creek to the Victoria River. The same organisation extends a long way into Western Australia.

I now desire to amend Table No. 1[1] of the article in question, by re-arranging the names of the sections composing the phratries, which I now think ought to be tabulated as follows:—

TABLE VI.

Phratry.	Husband.	Wife.	Son.	Daughter.
A	Choongoora	Nungulla	Chabalya	Nabajerry
	Chinuma	Naola	Changary	Nermana
	Choolima	Nanagoo	Chapota	Nemira
	Chungulla	Narbeeta	Chambijana	Nambijana
B	Chapota	Nabajerry	Choolima	Naola
	Chambijana	Nermana	Chungulla	Nungulla
	Changary	Nambijana	Chinuma	Nanagoo
	Chabalya	Nemira	Choongoora	Narbeeta

Let us take an example from the first name in the table: Choongoora marries Nungulla as his tabular or "direct" wife, or "No. 1." He takes Naola as his "alternative" spouse or "No. 2." He mates

[1] Queensland Geo. Journ., vol. xvi, p. 70.

with Nanagoo as his "rare" wife, or "No. 3." And he can marry a Narbeeta woman as "No. 4," which I have provisionally called the "exceptional"[1] spouse.

The section to which the offspring belong is determined through the mother. Thus, if Choongoora espouses Nungulla, his children will have the section names given in the table. With a Naola wife they will be Changary and Nermana. If he mates with a Nanagoo woman they will be Chapota and Nemira. And if he be united to a Narbeeta partner, his offspring will be Chambijana and Nambijana.

In an article which was read before the American Philosophical Society at Philadelphia on 5th May, 1899,[2] I described the sociology of some tribes on the McArthur River and surrounding country, in the Northern Territory. In dealing with the same tribes in the following year, I mentioned the Binbingha[3] as being one of the McArthur River tribes, and supplied a map defining their hunting grounds.

In the table of intermarrying divisions published at that time, the feminine forms of the section names were omitted, the masculine only being given. I explained then that the omission was made to allow of a comparison of the table with other tables in which the feminine names were likewise wanting. I now propose, therefore, to supply a new table, giving both masculine and feminine names in full:—

TABLE VII.

Phratry.	Husband.	Wife.	Son.	Daughter.
A	Joolanjagoo	Nungalagoo	Bullaranjee	Nulyarama
	Jinagoo	Nooralagoo	Bungaranjee	Nungarama
	Jooralagoo	Ninagoo	Jameragoo	Nameragoo
	Jungalagoo	Noolanama	Yukamurri	Yukamurrin
B	Jameragoo	Nulyarama	Jooralagoo	Nooralagoo
	Yukamurri	Nungarama	Jungalagoo	Nungalagoo
	Bungaranjee	Yukamurrin	Jinagoo	Ninagoo
	Bullaranjee	Nameragoo	Joolanjagoo	Noolanama

In tho Binbingha and adjacent tribes, the marriage and succession of the sections follow the same laws as in the Inchalachee and Neening communities described in the preceding pages. Joolanjagoo can marry Nungalagoo, or Nooralagoo, or Ninagoo, or Noolanama, and the section name of the progeny would be different in each case, as shown in the above table.

There is no doubt whatever about the devolution of the *section* names being regulated through the mother, but the descent of the *totemic* names has not yet been investigated to my satisfaction. When

[1] Journ. Roy. Soc. N.S. Wales, xxxviii., p. 305.

[2] Proc. Amer. Philo. Soc., vol. xxxviii, p. 77, Table III.

[3] American Anthropologist, vol. 2, N.S., p. 498 with map.

dealing with the subdivisions of the Chingalee, Koodanjee, Binbingha, and other tribes in 1900,[1] I stated that "the totems descend generally from a father to his offspring, but this rule is subject to modification." In the next year, 1901, in referring to the totems in the same region, I said "In this matter, irregularities have been observed, which I am now investigating. . . . Examination of the totems shows that some of them follow the father, and some the mother, whilst others inherit the totem of neither parent."[2]

A careful study of tables V, VI, VII will show that in the tribes therein dealt with, there cannot be any fixed rule of descent of any specific totem from a father to his offspring. For example, if we provisionally assume that descent is counted through the father, it can easily be exemplified that any given totem could be transmitted through all the eight sections. In such a case the partition of a tribe into two exogamous portions would be impossible, and consequently we may safely assert that the totems do not invariably devolve from a father to his children.

As I have before said, it is very difficult to fix definitely which is the best way to separate the eight sections into two phratries or moieties, more especially in any tribe where the totemic succession is irregular. In the foregoing Tables V. VI., and VII., under the heading "Wife," I have placed together the four sections of women, over which a man of a certain section has potential marital rights in a prescribed rotation. Then, opposite to these women, under the heading "Husband," I have placed the four section names of their respective normal husbands, as in Phratry A, Table VII., for example.

The "Sons" and "Daughters" of these men and women become the four intermarrying sections—the "Husbands" and "Wives"—in Phratry B, in a certain order. A glance at the tables will render any examples unnecessary. That is to say, the "Husbands" and "Wives" of Phratry A, produce the "Husbands" and "Wives" in Phratry B, and *vice versa*; or in other words, the phratries reproduce each other in continuous alternation. What may perhaps be an objection to this tabulation is, that the people in the "Sons" and "Daughters" columns intermarry with sections of their own phratry, instead of marrying into the opposite phratry, which is an innovation on all previous tables published by me.

In examining the social structure of all the tribes represented in Tables V., VI., VII., we discover that the women of a tribe are classified, by native custom, into two distinct sets, which we may

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[1] American Anthropologist, vol. 2, N.S., pp. 495-498, with map.

[2] Queensland Geographical Journal, vol. xvi, p. 71 and pp. 85-86.

distinguish as cycles, each of which comprises four specific sections. Each of the two sets or cycles reproduced its own four sections in a certain rotation. This can be made clear by a modified form of Table VII., which is a copy of my table of the Binbingha and adjacent tribes, published in 1899,[1] above referred to.

TABLE VIII.

Phratry.	Husband.	Wife.	Son.	Daughter.
A	Joolanjagoo	Nungalagoo	Bullaranjee	Nulyarama
	Jinagoo	Nooralagoo	Bungaranjee	Nungarama
	Jameragoo	Nulyarama	Jooralagoo	Nooralagoo
	Yukamurri	Nungarama	Jungalagoo	Nungalagoo
B	Jungalagoo	Noolanama	Yukamurri	Yukamurriñ
	Jooralagoo	Ninagoo	Jameragoo	Nameragoo
	Bungaranjee	Yukamurriñ	Jinagoo	Ninagoo
	Bullaranjee	Nameragoo	Joolanjagoo	Noolanama

In studying the upper half, or Phratry A, of the above table, we see that the women in the "Mother" and "Daughter" columns reproduce each other in a fixed order. For example, Nungalagoo has a daughter Nulyarama; Nulyarama produces Nooralagoo; Nooralagoo produces Nungarama; Nungarama is the mother of Nungalagoo, being the section name with which we started. It is evident, therefore, that the women of a phratry or set pass successively through each of the four sections of which it is composed, in as many generations—the same section name reappearing in the fifth epoch. If the totems were transmitted through the women, they would remain constantly in the same set, and reappear in the same rotation as the women. But such is not the case.

Another tabulation of the eight sections was submitted by me in 1901, at p. 71 of vol. XVI. of this Journal, in which the section names given in Table VI. of the present treatise were differently arranged. On that occasion, I showed that one moiety, or phratry, or group—whichever of these names we choose to employ—consisted of the sections Choongoora, Chinuma, Changary, and Chabalya; and that the other moiety comprised Chungulla, Choolima, Chapota, and Chambijana. See also the table at p. 60, vol. XIX. of this Journal. In both the tables quoted, and in others published elsewhere, I submitted that the moieties and totems had descent through the men; but extended enquiries have modified my views.

At different times, I requested my correspondents to make enquiries from the aboriginals in their own locality, with a view to ascertaining if the eight sections could be divided into two parts,

[1] I obtained the section names of the McArthur river tribes, and how they intermarry, from Mr. M. Costello, author of "Harold Effermere, a Story of the Queensland Bush." See Queensland Geographical Journal, vol. xix., p. 54.

such that each part could be distinguished by a common name comprising the four specific sections of which it was composed, on the same principle as the phratry names of the Murawarri and Baddyeri tribes, given in earlier pages, but I was not satisfied with the results. Neither am I satisfied with the results of similar attempts published by other authors..

In an article contributed to the Anthropological Society at Washington in 1900, dealing with the Wombaia and other tribes in the Northern Territory, I stated that "the totems have certain country assigned to them; for example, the kangaroo, eagle-hawk, emu, white crane, and so on, will each have certain plains, ridges, scrubs, water-holes, and the like."[1] I directed my correspondents residing in that locality to make certain further enquiries, which not only confirm what I then said, but enable me to arrive at more definite conclusions regarding the succession of the totems, of which the following is a very brief outline.

According to the legendary lore of the natives, the mythic ancestor of every totem resided in a specific locality. In those olden times, as at present, the totemic ancestors consisted of families, or groups of families, who had their recognised hunting grounds in some part of the tribal territory. They were born there and occupied it by virtue of their birthright. Some of them would be, let us say, galahs, others porcupines, others crows, others snakes, and so on. Moreover, the members of these family groups were divided into the same eight sections as the people are now. Some of the traditionary totems were invested with greater authority than others, like the "headmen" of local groups at the present day.

When one of these legendary people died, his spirit went into some well-known spot in his own hunting grounds, such as a rock, tree, hill, water-hole, or into the earth. He might also, by means of his superhuman qualifications, leave some of his attributes as a sort of spirit offspring, at different places, such as where he camped at various times, or did some notable deed, or worked some incantation, or the like. The sites of these several actions were scattered over different parts of the locality he occupied. All the other members of the family group had, of course, equal rights to the same hunting grounds as he, and left their spirits at certain places in a similar manner. In the course of many generations, all the camping places, water-holes, large rocks, hills, and so forth, in their own tract of country, would become saturated, so to speak, with spirits. There would be galahs at some places, snakes at others, kangaroos at others, and so on. The location of all these notable spots has been handed down by oral tradition to the present natives, who give a

[1] American Anthropologist, vol. ii., N.S., p. 497. Queensland Geo. Journal, vol. xvi., p. 72.

poetical and much embellished account of the doings of their various ancestors.

In all aboriginal tribes there is a settled belief in the reincarnation of the shades of their predecessors. Conception is supposed to be altogether independent of sexual intercourse. When a woman for the first time feels the movements of the child in the womb, commonly called "quickening," she takes notice of the spot where this occurred, and reports it to the people present. It is believed that the spirit of some deceased progenitor has just at that moment entered the woman's body. The entry may have been through some one of the natural openings, or through any part of the skin.[1] When the child is born, it will be assigned the totemic name of the mythic ancestor belonging to the particular locality. For example, if the "quickening" happened near a rock, or hill, or water-hole, or camping place, where the spirit of a galah was known to be hovering about, the infant would belong to the galah totem, altogether irrespectively of the totem of either the father or the mother.

Regarding the succession of the totems, it is important to remember that in all native tribes, a wife is taken away into the group or triblet of her husband, and roams about with him through his country. If he be, for example, a crow, he and his wife will spend most of their time among the specific haunts of his ancestor. When his wife first becomes conscious of being *enceinte*, she will probably be staying at a spot associated with some of the crows of earlier times, because she is living in a crow-man's country. In such case, her child will be a crow the same as its father.

Should the woman, however, be on a visit to her own people at the time of the "quickening," the chances are in favour of the fact being connected with one of her own ancestors, say a porcupine. Then the child would be a porcupine the same as the mother. Again, if the woman, at the critical moment, happened to be at a part of the common hunting ground where the pigeon spirits predominate, her infant would be a pigeon. In this way, there could be children of the same parents all possessing different totems. But as this married pair would naturally frequent their own crow tract more than anywhere else, as stated in the last paragraph, their crow progeny would be the most numerous, or all their children might be crows. This has given rise to the erroneous belief among the white settlers that the descent of the totems is through the father.

APPENDIX.

My attention has just been drawn to some remarks by Professor Baldwin Spencer, in a paper which appears in the Tenth Report of the Australasian Association for the Advancement of Science. He

[1] "Folklore, Manners, &c., South Australian Aborigines" (Adelaide, 1879), p. 88.

says at p. 380 of that publication: "Mr. R. H. Mathews has published a somewhat extensive series of papers, which, so far as they refer to the organisation of New South Wales and Victorian tribes, for the main part simply corroborate or make use of the works of Messrs. Howitt, Fison, Ridley, and others, without adding any matter of importance."

The gross inaccuracy of the above statement will be manifest on referring to my book, "Ethnological Notes on the Aboriginal Tribes of New South Wales and Victoria," in which I have given descriptions of the organisation of some tribes in both those States, which had never been even mentioned before. That publication will completely revolutionise all the old-school notions respecting the organisation of Australian tribes. If the first two men named by Professor Spencer had never been born, it could not have made an atom of difference to my work.

Professor Spencer again says, "Mr. Mathews deals also with the organisation of certain tribes in the northern parts of Central Australia. His information is second-hand, and he arbitrarily arranges the sub-classes (sections) so as to fit in with maternal descent. In every case in which I have been able to test Mr. Mathews' description of the organiation, I have found that either his information or the conclusion he has drawn from it is incorrect."

In 1898 I described the eight sections of the Wombaia tribe; in 1899 the Binbingha sociology was dealt with; in 1900 and 1901 I reported the eight sections of the Chingalee tribe, with a comprehensive map showing the location of them all. I was unquestionably the first author to publish the organisation of the three tribes mentioned.

Some years afterwards, in 1904, Messrs. Spencer and Gillen published their "Northern Tribes of Central Australia," in which, at pp. 100, 101, and 111, they confirmed the section names of the Wombaia, Binbingha, and Chingalee tribes, previously reported by me. There were trifling differences in the spelling, but the sound was substantially and unmistakably the same.

Spencer and Gillen, when preparing tables illustrating the organisation of the three tribes last named, divided the people into two sets of four sections each, in such a way that the descent of the phratries (or moieties) was represented as being through the men, similar to my table given at p. 60 of vol. xix of this Journal, and to my table at p. 129 of vol. xxxiv. of the Journal of the Royal Society of New South Wales (1900), excepting that the two pairs of sections composing a moiety were arranged differently.

For example, I gave Choolum and Palyarin as one pair, and Cheenum and Bungarin as the other pair, in moiety A. But Spencer

and Gillen gave Choolum and Cheenum as one pair, with Palyarin and Bungarin as the other. I am using my own spelling of the names, as originally published seven years ago. These co-authors also profess to have discovered native names for the two moieties into which the tribe is divided. But my important discovery that the men married wives whom I have designated "No. 3" and "No. 4," entirely escaped their notice, and does not appear in their book.

What then is the object of Professor Spencer's unfounded assertion that my "information is incorrect," when he himself corroborates its accuracy in all essential points. Then, as regards my information being "second-hand," I wish to say that my correspondents have resided for many years in that district, and I have much more confidence in them than in Professor Spencer.

Finally, so far from "arbitrarily arranging the sections so as to fit in with maternal descent," I have on several occasions submitted tables showing how descent might take place through the men. Bearing in mind that the descent of all the sections is absolutely determined through the mothers, and that the totems of the offspring do not follow either parent, the difficulty of deciding what specific four sections constitute a moiety will be readily understood.

CORRECTIONS.

Vol. xvi. of this Journal, p. 74, line 21, strike out the words, "According to my investigations his conclusions are correct."

Vol. xix., p. 61. line 7, strike out the words, "and the rare."

In vols. xvi. and xix., throughout my "Ethnological Notes," wherever it is said that descent of the totems is through the father, it must be taken in the qualified sense given in the present treatise.

Please also read "Correction," given at p. 72 of vol. xix. of this Journal.

THE ANTARCTIC:

BEING THE ANNIVERSARY ADDRESS TO THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.*

By the Right Hon. Sir HUGH M. NELSON, K.C.M.G., D.C.L., F.R.G.S., etc., President.

Ladies and Gentlemen,

I thank you cordially for the honour of being re-elected as your President. I esteem the position very highly, and, although I have not as much time to devote to it as I would wish, still, I am willing to do what little I can in the interests of the Society.

The last year has been fairly progressive, although our income is not as good as it was the year before, and not, by any means, as good as we would like—and not so large as we could put to very good use indeed if we had the money.

It is usual for the President, on an occasion of this sort, to occupy the evening by delivering some address. On two or three occasions before I have directed your attention to the Antarctic regions. I am afraid of exhausting your patience on that particular subject, but I think it is just as well that we should know what has transpired since our last annual meeting. I brought up the history of the exploration, last September, to the time when the exploring ship "Discovery" had been released from the ice, and had arrived again in England. Since then many of the scientific men and officers of the expedition have given us some account of the work that they did in those Southern regions, and I thought it would be well to follow up what has been already said on the subject by giving you a short résumé of some of the points which are of particular interest. I may say that the quantity of knowledge and information which have been disseminated is so large that it is very difficult for me to choose the particular subjects to which to direct your attention; but, having been favoured by the parent Society—the Royal Geographical of London—with some lantern slides, I will this evening confine my attention principally to subjects which I shall be able to illustrate by means of those slides.

The one great object for which the expedition was fitted out was the study of megnetism, a science which, as I think you are all aware,

* Read at the Royal Geographical Society of Australasia, Queensland, July 11, 1905.

may be said to be in its infancy. It is a most mysterious science, and there are problems connected with it that will probably take years to elucidate. For instance, we are all familiar with the mariner's compass—a magnet poised upon a sharp point so that it can work freely—and we have all been accustomed to think and believe that when so left it will invariably point to the North Pole. Such, however, is not the case; in fact, it hardly ever points to the true North Pole. That was discovered in the fifteenth century by such a navigator as Columbus, but why it varies in this way is one of those things which we have still to discover. A great many nations—Germany, Sweden, Britain, United States, Argentine Republic—have joined in sending out expeditions to make discoveries, and it will take years to collate the results of their observations. They have to be worked out, first of all, by the observers, the "Discovery" being the principal one; after that they have all to be collated, not only with the expeditions, but also with the various observatories—Melbourne, Bombay, Germany, Kew, and last, but not least, the one at Staaten I., established by the Argentine Republic.

I have a little chart here, which I think may give you some idea of what the problem is. It is one of the Admiralty charts of the Pacific Ocean, which I got for the purpose of marking on it the Pacific cable. Suppose you make a voyage from Brisbane to Fremantle, when you get outside Moreton Bay to the ocean you come to a magnetic curve, where the compass points 9° to the E. of N. As you sail down, you come to another curve, where the compass points 10° to the E.; when you get further down, you come to a curve where the compass points 11° to the E., and, further down still, there is a curve where it points 12° to the E. When you pass that, the deviation becomes a diminishing quantity until you come to the magnetic equator at the Great Australian Bight, where the compass points due N.—that is to say, the magnetic pole and the geographical or astronomical pole are in line. When you get beyond the magnetic equator in the voyage to Fremantle, the reverse takes place, and the compass points more and more to the W. of N., until it deviates as much as 40° from true N. You see, therefore, that, if navigators were to trust entirely to the compass, they would be very often in great danger. But the navigator does not do so. It is his duty—and his invariable custom, as far as my experience goes—to verify his compass; and that he can do either by observations of fixed points upon land, if he is near land, or by observations of the heavenly bodies, which are always, as the Americans say, "on time." Whenever the weather permits, and observations of the heavenly bodies can be taken, the navigator can always tell where the true N. is, and can thus verify his compass.

The history of the compass is wrapped in mystery. One thing seems to be fairly well proved—sufficiently proved, at least, to satisfy

such an acute investigator as Lord Kelvin—that the Chinese, as far back as 2350 years before the Christian era, were aware of this characteristic of the magnet—namely, that if left to work freely it would point towards the N. The ancient Romans and Greeks knew that the loadstone, or magnet, would attract iron, but they never discovered that it had this directory power. And, though the Chinese knew this for so many centuries, still the knowledge does not seem ever to have travelled to the West towards Europe, because there is no record to be found of the use of the compass until about the 11th century of the Christian era; and history is also silent as to who made the discovery. It was not got from China; it must have been an independent discovery by someone in Europe; but the man who made the discovery, and who deserved the credit of inventing an instrument of everlasting utility to the human race, is unfortunately unknown.

The curves marked on the chart to which I have referred are all derived from what I call empirical knowledge—that is to say, we know that the magnet acts in the way I have described by observation, but why it does so, and how long it has continued to do so, and other points of that sort, are things still undiscovered. It has been fairly well established, however, that the magnetic pole, which is about 20° from the geographical pole—that is, the extremity of the axis of the earth—in some way circulates round the true pole, but at a very, very slow pace; and it is reckoned that if the compass points in a certain direction with a certain variation to-day, it will keep varying for about 480 years, until it points again in exactly the same direction.

PACK ICE.

According to Captain Robert F. Scott, C.V.O., R.N., commander of the expedition, the ice-conditions in the Ross Sea have been observed in the course of five different summers. Although differences in date make it impossible to closely compare those seasons, one is led to believe that four were very similar, and constitute the normal condition, whilst one, the summer of 1902-3, was exceptional. The normal condition seems to be that the sea becomes completely frozen over in the winter, the movement of the ice-sheet leaving narrow spaces of open water only at its edge in such places as the northern face of the Great Barrier, and possibly in occasional rents, which are speedily re-frozen. The Emperor penguin undoubtedly takes advantage of the continual strip of open water that fringes the barrier.

The gales at Cape Crozier grow excessively violent towards the end of September and in October, and by this time the sun has taken some effect on the ice-sheet. The general break-up which results has been witnessed on two occasions by our sledge parties; one day they saw the sea completely covered with ice, and the next looked forth on

Officers and Crew of the "Discovery."

a clear sheet of open water. The ice thus freed drifts to the north, and forms that belt of pack through which ships must pass to reach the Ross sea in the early summer. Drifting under the influence of wind, loose pieces of ice will always travel faster than the main pack, and consequently the southern edge of the band will generally be a hard and fast line, where loose pieces are crowding on the main pack, and the northern edge will be free, where loose pieces are tending to detach themselves from it.

Towards the end of December and the early part of January this belt extends from the Antarctic circle for about 200 miles to the South, and, as Captain Colbeck has said, is probably best attacked on the meridian of 178 deg. to 180 deg. E. To the westward of this the pack would be augmented by the coastal ice of Victoria Land, and to the eastward by conditions which are not well known, but on which the discovery of Scott Island and the difficulties experienced by Ross seem to throw some light.

ICEBERGS.

The main supply of icebergs in the Ross Sea is from the Barrier and the eastern land. The glaciers on the coast-line of Victoria Land are in an extraordinary condition of stagnation, and nearly all the bergs met with along the coast have undoubtedly come from the east. From Cape Adare to Cape Crozier there are only two ice-flows capable of giving off a clean tabular berg of any dimensions. The rate at which various regions give off bergs can be to some extent gauged by the comparative newness of the exposed faces of the ice-cliffs. . . .

The size of Antarctic icebergs has been the subject of some discussion, and there is much excuse for exaggeration. Of the many hundreds seen by us, very few exceeded a mile in length or 150 feet in height; the vast majority were less than a quarter of a mile across and less than 120 feet high. The largest iceberg we saw was off King Edward's Land, apparently aground. We estimated it as about five or six miles in length, and it seemed to run back for an equal distance. In this region we also saw some very high bergs, and one is logged as 240 feet.

The proportion of the submerged to the visible part of an Antarctic iceberg was estimated by Sir John Murray as about 7 to 1. I am inclined to think that it is much less, but I have no exact measurements to adduce. My opinion is founded—firstly, on general observation of the depth in which the bergs ground (120 to 150 feet bergs do not seem to touch bottom in more than 100 to 120 fathoms); secondly, on an eye-estimate of the proportion, as indicated in an overturned berg; and, thirdly, on the nature of the ice itself as exposed in the face of the berg, or of the cliff from which it has come, the transition from snow to ice is very gradual, and strongly

impresses one that the mass throughout must contain large quantities of air. For the above reasons, I am inclined to place the proportion as not greater than 5 to 1. Mr. Ferrar has some data concerning the æration of ice taken from different parts of a berg, which might help to give an approximation. This factor appears to me of great importance, not only in calculating the mass of bergs, but as giving an indication of the thickness of the ice-sheet covering many parts of the Antarctic lands.

GLACIERS.

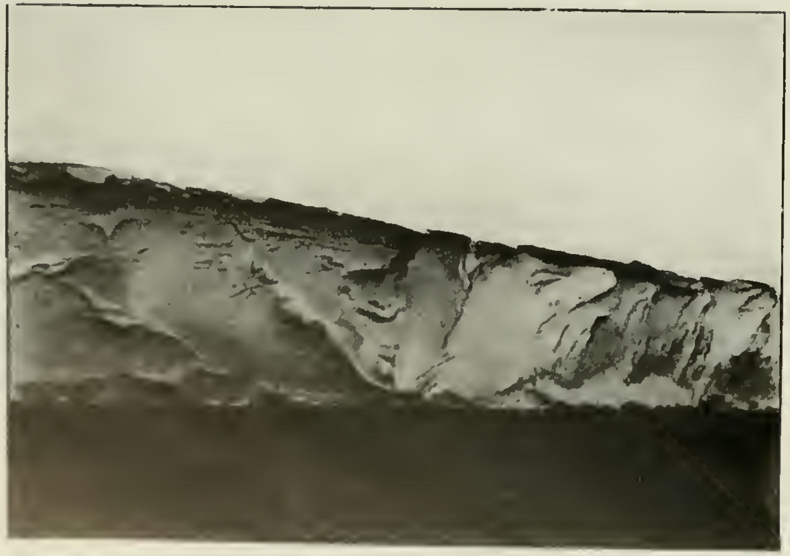
"There are innumerable glaciers on the coast of Victoria Land," says Captain Scott, "but the great majority merely discharge local *névé* fields lying in the valleys of the coastal ranges. Very few run back to the inland ice, and these may be divided into two classes—the living and the dead. In the long stretch of coast between Cape Adare and Mount Longstaff, over 11 deg. of latitude, there appears to be only four living ice-discharges from the inland. The Ferrar Glacier is typical of the dead glaciers; the ice lies in the valley practically stationary, and gradually wasting away from the summer thawing. The Ferrar Glacier probably contains as much ice as any hitherto known in the world; the Barne and Shackleton Glaciers contain a great deal more, and, since they are now in such a diminished state, it is interesting to think what vast streams of ice they must have been at their maximum. To what extent the inland ice sheet stood above its present level is also interesting to surmise; one would submit a possibility of 400 or 500 feet."

THE GREAT BARRIER.

It is already known that I believe the greater portion of this great ice-sheet to be afloat. I will endeavour to give my reasons for this belief.

In considering the northern edge on the chart, if the figures showing the height in feet be taken as giving the depth in fathoms, a proportion of 6 to 1 for the submerged part will be allowed, and this I have already given reason for showing is an ample allowance. Since the soundings are given in fathoms, it will be seen that some hundreds of fathoms of water still intervene between the bottom of the ice at the barrier edge and the floor of the sea; but the barrier edge sixty years ago was in advance of its present position, in places as much as 20 or 30 miles, and therefore our soundings lie directly beneath Sir James Ross's barrier, and a considerable distance from its edge. The part that has broken away must, therefore, have been water-borne, and this, at least, shows the possibility of the remainder of the ice-sheet being afloat for an almost indefinite distance to the south. Had there been any doubt about the flotation of the barrier

The Western Glacier.



The Great Ice Barrier.

Typical Antarctic Iceberg.

edge, it must have been dispelled by the fact that during our stay in the eastern inlet, although we had evidence of considerable tidal movement, the ice rose and fell with the ship. . . .

After our observation of the stagnant condition of the ice about our winter quarters and in the Ferrar Glacier, the report of the barrier movement came as a surprise. Its discovery was more or less accidental. In September, 1902, I established Depôt A on the exact alignment of a sharp volcanic peak on the extreme end of the Minna bluff with the summit of Mount Discovery, the line running about west-north-west and east-south-east. On visiting this spot in 1903, Mr. Barne found that the alignment was no longer "on," and thirteen and a half months after the establishment of the depôt he carefully measured its displacement from the original line, and found it to be 608 yards. The direction of its movement must be a little to the east of north, and consequently this figure probably represents the whole movement during the period.

Erebus smoke blew almost persistently to the east, but we could not always exactly gauge its direction. It is curious to find that every sketch made by the Ross Expedition shows it going to the west, and Sir Joseph Hooker can remember it going in no other direction.

TOPOGRAPHY.

Mr. Ferrar in his notes says: South Victoria Land consists of a great range of mountains, which reach in an almost continuous belt from the latitude of Cape Adare to the latitude of Mount Longstaff, a distance of 800 miles or so. The heights vary from 15,000 feet, of which there are three or four peaks of that height, to 4,000 feet, and it is remarkable that there is no extensive area of land of a less height than 4,000 feet.

This range appears to be the eastern extremity of a great mass of land, and buttresses a vast interior ice-field, traversed for 200 miles by Captain Scott in a westerly direction. Captain Scott found this inland ice to be of an almost uniform level, and to maintain this level at a height of 9,000 feet above the sea. This inland ice drains into the sea through valleys at right-angles to the length of the mountain range—(see the charts published by the Royal Geographical Society)—and in this way gives rise to two of the largest glaciers in the world. . . .

In addition to the main mountain range of South Victoria Land, we have isolated volcanic cones or volcanoes, though only one—Mount Erebus—is now active. These volcanoes, as a rule, lie at the base of the mountain range, in comparatively low land, and as often as not slope down directly into the sea. They are all conical, though not so steep as those of Japan, and several have craters at their sum-

mits, as is proved by the cone being truncated. They are all of considerable height, and can be seen to cover large areas if reference is made to the charts.

Mount Erebus, 12,760 feet high, shows three marked stages in its growth—

(*a*) The lip of a huge crater, running round it as a girdle at a height of about 6,000 feet above sea-level.

(*b*) A second lip, at an altitude of 10,000 feet, of a younger crater, from which streams of lava have welled up and flowed down its sides.

(*c*) The present small cone, built up asymmetrically inside the second lip, and from which the steam now issues.

Mount Terror, like Mount Erebus, is completely covered in snow, except in the more exposed spots, where either the wind blows the snow away, or the slope is exposed to the sun, which evaporates the snow as fast as it falls. This mountain is 10,884 feet high, and has a perfect crater-rim at its summit, probably half a mile across; there are also occasional parasitic vents on the east side of Terror, but on the south and west sides the covering of ice and snow is so heavy that vents, if present, could not be distinguished.

Mount Discovery, like the two former, is thickly covered in snow on the south side, though on the north side it is practically bare. This mountain stands on an almost circular base, and is connected to the mainland on the west by a low dome (Mount Morning). This latter forms the right bank of the Koettlitz Glacier, which flows out to the north into McMurdo Bay, along the base of the Royal Society Range.

Mount Melbourne, 8,560 feet, the last of the volcanic cones which I will mention here, like the rest, is isolated, but lies more among the mountains than do the others, except, of course, Erebus and Terror, which form an island of themselves. It is rather steeper than the others, tapering up almost to a point, but, being truncated, probably has a crater at its summit a quarter of a mile in diameter. On the north side it rises sharply out of Wood Bay—one of the largest indentations in the comparatively straight coast-line—while on the east it stretches out into a long promontory—namely, Cape Washington.

SEA ICE.

The sea ice that has been seen presented nothing of special interest in its formation or behaviour. McMurdo Bay was guarded by a line of pack-ice from Cape Bird westward. When the "Discovery" entered the bay, in February, 1902, this line had to be cut before the open water was reached, this open water not freezing over

Emperor Penguin Rookery.

Mt. Erebus with smoke.

finally until May, although it had been practically frozen in April. The bay remained covered in a uniform sheet of ice until February, 1904, when a general break-up took place.

The ice, as a rule, does not attain a thickness greater than 8 feet by direct freezing, but where snow accumulates locally the thickness produced in a season may be as much as 40 feet. So also, locally, direct freezing will produce a thickness of 12 feet where the land prevents a rapid circulation of the water; and, on the contrary, where there is known to be a strong current, the ice, though freezing to a thickness of 8 feet during the winter, will be completely melted through during the summer.

METEOROLOGY.

Lieut. Royds in his notes says: Throughout the whole of our stay in winter quarters, we recorded no wind from the west or north-west, except occasional light airs. Winds from the north were more common in the summer, and especially during our last one. Gales from the south-east were generally accompanied by low temperatures, and on more than one occasion the temperatures have been below —40 deg., with a wind-force of 7 to 8 blowing, making life outside the ship far from nice. But the worst gales were from the south and south-west, and we used to call them blizzards, as they were invariably accompanied by absolutely blinding drift snow. It is really a very difficult thing to anyone who has not experienced a gale of this description to know what happens.

The air is entirely filled with driving snow, which strikes you just like a sand-blast. You cannot face it, but have to stumble on to wherever you may be going with your head down and arms protecting your face; and, even could you face it, you are not able to see a yard all round you. I will give you an instance of how blinding they are. Whilst preparing for the winter after our arrival in the bay, and after the sea had frozen over, posts connected with ropes were led to every place where it was necessary to go every day—that is, to the magnetic huts and living hut, and to the meteorological screen.

It was during the latter part of the first winter that what might have been a serious affair happened. You may have heard that we had at times concerts, theatricals, and at one time a nigger troupe, to liven things up. Now, it was no good rehearsing these things in the ship, as everyone would know exactly what was going to be done, and the jokes to be made; consequently, it meant the performers going over to the living hut for the rehearsals, and, as in this palace of varieties there was invariably a temperature of —20 deg. and below during the time we were rehearsing, it was no great pleasure playing the piano. It was on one of these occasions that I had taken the party across to the hut to rehearse the nigger troupe, and it was

blowing a hard blizzard, with exceedingly low temperatures. On arrival at the hut, we found two officers, Mr. Skelton and Mr. Bernacchi, taking pendulum observations, but they left before we started our rehearsal. We finished in about an hour and a half, and then started back to the ship. As usual, one cautioned the men to keep together, and not let go the rope which led back to the ship. We had got about half-way across, the whole distance being only about 200 yards, when I heard a shout, and knew that, as it was none of my party, someone must be adrift from the ship. We opened out, and found Mr. Skelton and Mr. Bernacchi, who were quite lost, and who had been wandering about for an hour and a half, unable to find out their whereabouts. Both were more or less frost-bitten about the face, and were exceedingly glad to have been found.

SEALS AND BIRDS.

Dr. Wilson in his notes says: The Weddell seal is the one we saw most often, and practically *lived on* for a year and a half. The flesh is dark and coarse, but not always tough. The blubber alone is rank, and must be carefully dissected off the joint. The liver is most delicious. The Weddell, unlike the others, is a shore-going seal, and is seldom seen in the pack of the open sea away from land. We had large numbers of them with us all the summer, and during the winter they were only less in evidence because they lived and slept chiefly in the water. They are very slow and sluggish on the ice, but in the water as rapid as a fish. . . .

It is noteworthy that all these seals are what are known as earless seals, and hair seals, as opposed to eared seals, which may be fur or hair-bearing. The sea-lions and sea-bears of the sub-Antarctic area have never been recorded from the ice. Sea-lions, which we saw in abundance at the Aucklands, are hair-seals, with a small external ear. Sea-bears—which occur also at the Aucklands, but were recently almost extinct, and are now most carefully preserved—are fur-bearing seals, with a small external ear. Both sea-lions and sea-bears still use their hind limbs for progression on land; but none of the Antarctic seals do this, nor have any of them an external ear, nor have they anything more like proper fur than has the horse.

The commercial value of the skins of the southern seals is very small. They make good leather, and now that hair-seals are being used for motor coats, their value may go up; but so far the Antarctic seal-fishery has never met with much success. The abundance of the Killer whale in the south must always have a depreciating effect on the value of these skins, for hardly one in eight or ten is free from the most unsightly scars. The Weddell seal, which has learned to avoid migration, and remains far south throughout the year, is the least affected by them, and as his coat is the most handsomely marked

Adelie Penguins.

The Great Chasm.

of all, it is possible he may yet be wanted by the sealers. He lives, however, in secluded bights and bays and straits, where the ice is always late in breaking up; and this, I think, would always be his main defence, for ships could not get at him till the end of the navigable season. In these secluded bays the Weddells collect in the spring, and in October and November the young are born, in a woolly coat, which they begin to throw off in fourteen days. At the end of a month it is all gone, and the young one then follows its mother into the water, and soon becomes independent. . . .

The Emperor and Adélie penguins are strictly ice-birds, as are also the Snow petrel and McCormick's skua. The Antarctic petrel migrates northward in the winter, and frequents the ice within the Antarctic circle in the summer, though where it breeds is still a mystery. Then, again, the Wilson's petrel breeds in the southermost regions, but wanders the whole world over at other times. The Giant petrel and the Southern Fulmar, Cape pigeons, certain Albatrosses, a Tern or two, and several of the Whale-birds, form yet another class which breeds in the sub-Antarctic area, and yet may constantly be seen in summer in the ice. The whole question of the geographical distribution of the birds seen in the south is, therefore, somewhat complicated.

The Emperor penguin is the most truly Antarctic bird of all. It keeps as far as possible, not merely to the limits of ice, but to the southern border of the floating ice, or the northern edge of what is fast.

The Adélie, on the other hand, goes south to breed, but as the winter night comes on, migrates to the northern edges of the pack. To the Emperor the pack-ice is a school and convalescent home, where the young are sent to change their first year's plumage, and the old ones go to moult and rest awhile from the fatigues of incubation, which, strange to say, in their case occupies the greater part of the Antarctic winter. The Snow petrel must be classed with the Adélie penguin, as it is never seen so far south as the Emperor in winter. Both the Adélie penguin, however, and the Snow petrel keep strictly to the ice, and Sir James Ross was right in looking upon the latter as an invariable sign of its proximity.

ANTARCTIC SEA-ICE.

Captain Colbeck in his notes says: From my experiences, I have no hesitation in saying that the pack should be entered between long. 178 deg. and 180 deg. E., as early in December as possible, and so take advantage of the whole of the open season. The ice between these meridians being lighter, more open, and easier to negotiate than to the westward, and, moreover, having no extent of land nearer than

the Balleny Island, there is very little danger of the ship being damaged by pressure. . . .

On December 25th, 1903, we sighted two small islands, bearing south-south-west, about 25 miles distant. We took a sounding when about five miles north-north-west of them, and got no bottom at 1,000 fathoms. The larger island is about $\frac{1}{4}$ mile long and $\frac{1}{8}$ mile broad, lying in a N. by E. and S. by W. true direction, the northern end being about 12·6 feet high, and "steep to." The southern end was lower, and partially covered with an ice-cap sloping from the northern end, and appearing to get much thicker where it discharged into the sea. The northern extremity was almost bare of snow, much weathered and weather-worn at the base of the cliffs. In each of the northern points there was an arched rock, the larger of which was about 80 feet high and 50 feet broad. The smaller island, which was almost circular, was about 200 feet in diameter, to a height of about 185 feet, with a conical top (the summit of which was about 209 feet above the sea-level), and was situated nearly a cable's length to the north-north-west of the larger island. These small islands were subsequently named "Scott Island" and "Haggitt's Pillar" respectively.

PROCEEDINGS

OF THE

Royal Geographical Society of Australasia,

QUEENSLAND.

20TH SESSION, 1904-1905.

REPORT OF COUNCIL.

In submitting the Twentieth Annual Report on the Society's operations during the preceding session brought to a close on the 30th June, 1905, the Council notes an accession of three ordinary Members to the roll.

In recording the losses sustained by those whom death has removed from the list of Members, feelings of the deepest sorrow overshadow the Council in having to announce the passing away at the ripe age of 86 years of the Honourable Sir Augustus Charles Gregory, K.C.M.G., M.L.C., F.R.G.S., who died at his residence "Rainworth," Brisbane, on Sunday mid-day, the 25th ultimo.

Of an indefatigable disposition, a genial and loyal colleague, an eminent Geographer, a kind friend to all who had the privilege of his acquaintance; a man of simple habits and rare intellectual attainments, and an active worker, up till within the last few days of his eventful career, Sir Augustus Gregory's name holds an honoured and revered place in the annals of this Society, as the first President. This position he ably filled for three consecutive years, and during subsequent terms, when called upon to occupy the presidential chair for shorter periods, at the spontaneous and unanimous wish of the Members, he contributed in no small measure to the success of the proceedings and the general welfare of the Society at large. He had always been an able and highly valued member of the administration, from the very first, and at the time of his death was an Hon. Councillor and Referee. As a more extended notice of his brilliant achievements in the field of exploration and discovery and of his pioneering work in other divisions of human activity, has already appeared in Vol. 18 of the Society's "Journal," in connection with his 83rd birthday celebration, no more need be said at present, fur-

ther than to add that his loss is a national one, and will be felt throughout the entire geographical world.

It is also with very deep regret that the death is likewise recorded of Field Marshal Sir H. W. Norman, G.C.B., G.C.M.G. C.I.E., who passed away last year at Chelsea Hospital, of which institution he was Governor. For a number of years Sir Henry Norman was the distinguished and widely beloved Patron of this Society, in whose work he took a deep and lively interest; not only whilst occupying the exalted position of Governor of Queensland, but after he left the colony he continued to interest himself in its welfare and progress up to the time of his death. At the Hobart Meeting of the Australasian Association for the Advancement of Science he represented the Society as special delegate, at the same time reading a paper on behalf of our Hon. Secretary, and in London he further proved his friendship and loyalty to the cause of our work, by rendering important services on the Council of the Royal Geographical Society as well as in the administration of the Royal Colonial Institute. Since leaving Queensland he had been an Hon. Member, in which capacity his services were of great value.

The Council has also the melancholy duty of reporting the death of Mons. Charles Gauthiot, for many years an esteemed Hon. Corresponding Member, and who was widely known as the distinguished Founder of the Sociètè de Gèographie Commerciale de Paris, and its Perpetual Secretary, to which position he had been unanimously elected by the entire body of Members, to mark their appreciation of his eminent services and wide influence on the intellectual life of the country. His death occurred on the 27th February last after many years' suffering from a painful malady, endured with serene stoicism. Of indefatigable energy and activity Mons. Gauthiot was a man of striking personality, possessing gifts of character and intellect which made a lasting impression upon every one brought within the range of his influence, and his death is felt as a personal loss in many countries. In 1891 he represented this Society at the Fifth International Geographical Congress held at Berne, and again in September of the following year he, conjointly with another Hon. Corresponding Member, Dr. Hugh Robert Mill, acted in a similar capacity at the Genoa Geographical Congress convoked by the Italian Geographical Society to celebrate the Fourth Centenary of the Discovery of America by Columbus. On both occasions he rendered excellent service.

Of the Ordinary Members of the Society the Council also alludes with profound regret to the loss sustained by the demise of Mr. E. N. Daniell, one of the original subscribers, and for many years a local public servant in the Survey Office, who

recently passed away at his home in England, where he had been residing for the last few years. Also Mr. John Ahern, of Charters Towers, Licensed Surveyor; Mr. G. T. Myles, of Warwick; and Mr. John James Noble, M.A., a graduate of Trinity College, Dublin, a local pioneer agriculturist, identified with the sugar planting industry of the East Moreton District, and a man at one time associated with the educational life of the State, but who in recent years had lived a somewhat retired and secluded life, being greatly handicapped by defective eyesight.

In consequence of the date of last Annual General Meeting having encroached upon the opening months of the current session now under review, the ordinary monthly meetings have not been so numerous as formerly, there being only six held altogether, and nine meetings of the Council. But all the same the actual active work accomplished has not been altogether unprofitable, as the following list of papers read will show, namely:—"Geography, Scientific, and Practical," by the Hon. F. T. Brentnall, M.L.C., "Geographical Units not Generally Known," by R. Cliffe Mackie; "Depressions and Upheavals in the Pacific and on the Australian Coast," by Captain W. C. Thomson; "Tasman: A Forgotten Navigator," by Captain Wm. Eaton; "Stradbroke Island—a Great Natural Reservoir and Filter of Water," by George Phillips, C.E.; "Some Notes on Palestinian Archæology," by W. P. F. Dorph, M.R.A.S.; "Ethnological Notes on Some Aboriginal Tribes of Queensland," by R. H. Mathews, L.S., etc.

In competition for the Society's Thomson Foundation Gold Medal, to be awarded annually or at such other times as the Council may approve, one paper has been received, on "The Geographical Distribution of Australian Minerals," but as it only came in at the end of June, it will have to be considered as part of the business of the ensuing session.

The Nineteenth volume of the "Queensland Geographical Journal" was printed as usual and issued to Members and "Exchanges" as formerly. It is satisfactory to note that the demand for the Society's publications continues to increase from year to year, rendering it sometimes difficult and occasionally impossible to satisfy the number of applications from all parts of the world, for recent and earlier issues.

Included in the business of the session was a report prepared by the Hon. Secretary, and adopted at a meeting of the Members held on the 27th April, in which it was recommended that the Government be requested to favourably consider the expediency of appointing a Board on Geographic names for the State of Queensland, such a body with executive authority, being

much needed to deal with the important subject of place-names, and Geographical orthography generally. The matter was duly brought under the notice of the Honourable the Premier, who has promised to give it favourable consideration.

Actuated by the strongest desire to serve the best interests of the Society, to economise labour and material, and to concentrate and apply available energies to the best advantage possible, the Council has resolved and arranged to revert to the original system of administration, whereby the offices of Hon. Secretary and Treasurer will in future be amalgamated, as formerly, and there will also be a more general and liberal recognition of discriminating executive action on the part of the Hon. Secretary in directing the affairs of the Society, and the non-restriction of his operations by formalities and rules of procedure in conducting the general business

The Council again recommend:—(1) The suspension of so much of the Rules as provides for the payment of an entrance fee; (2) The reappointment of Mr. Alexander Muir, J.P., as Hon. Councillor

The financial affairs of the Society are dealt with in the Balance sheet herewith submitted.

In conclusion, the Council desires to give expression to the general feeling of the Members at large in their very high appreciation of the splendid services rendered by the President, the Right Honourable Sir Hugh M. Nelson, who for a number of years has adorned the presidential chair and entered into the active life of the Society with such zeal, enthusiasm and energy as are rarely met with in positions of the kind.

Brisbane, July 5th, 1905.

BALANCE SHEET, 1904 1905.

THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND

Dr.

	£	s.	d.
By Balance brought forward—			
Royal Bank	27	12	7
Government Savings Bank	50	6	5
Cash in hand	0	3	0
,, Annual Subscriptions received	146	0	0
,, Interest on Gov. Savings Bank Deposit	1	10	0
	£225	12	0

Cr.

	£	s.	d.	£	s.	d.
To Expenditure as per accounts—						
Printing, Stationery, Postage, &c.	82	4	0			
Advertising, Reporting, &c... ..	1	12	3			
Fire Insurance, Rent of Safe, &c.	3	17	3			
Gas Account	0	16	1			
Monthly meetings, Cleaning rooms	5	14	7			
Sub. to "Nature" and P.O.O. ..	1	11	6			
20 Presentation copies "Round the World" and postage of same ..	8	19	0			
Hon. Sec., Petty Cash	7	10	0			
General repairs, Carpenter and Plnmber	1	3	6			
Sundry expenses	0	5	0			
				113	13	2
,, Bank Charges for Keeping Account ..				0	10	0
,, Exchanges as per Bank Pass Book ..				0	9	9
				114	12	11
,, Balance in Royal Bank*				59	2	8
,, Balance in Government Savings Bank ..				51	16	5
				£225	12	0

Examined with Bank Pacs Books, Vouchers &c., and found correct.

C. W. DE VIS, *Hon. Auditor.*

D. S. THISTLETHWAYTE, *Hon. Treasurer.*

Brisbane, July 5th, 1905.

* Less £25 Honorarium to Hon. Sec. paid since books closed.

H.M.N. 5/7/05.

ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

THE ANNUAL GENERAL MEETING

was held on the 11th July in the Society's Rooms, Public Library Building, William Street, Brisbane. His Excellency the Right Hon. Sir Hugh M. Nelson, K.C.M.G., D.C.L., F.R.G.S., President of the Society, was in the Chair, and the attendance was very large.

Messrs. A. H. Blackman, Norman Campbell, William Collins, and William Richard Parker, L.D.S. Eng., were elected Members of the Society.

On motion the Annual Report of the Council, including the Financial Statement, was taken as read and adopted.

After the suspension of so much of the Rules as to admit of the re-election of the President and Vice-President, the following Officers and Council were elected for the ensuing session, 1905-06:—

President: Rt. Hon. Sir Hugh M. Nelson, K.C.M.G., D.C.L., F.R.G.S. Vice-President: Hon. Arthur Morgan, M.L.A. Hon. Secretary and Treasurer: J. P. Thomson, LL.D., Hon. F.R.S.G.S. Other Members of the Council: L. F. Schoenheimer, J.P.; Lieut.-Col. James Irving, M.R.C.V.S.L., etc.; G. Phillips, C.E.; Hon. F. T. Brentnall, M.L.C.; John Cameron, M.L.A.; Hon. John Leahy, M.L.A.; G. Fox, M.L.A.; A. M. Hertzberg, J.P.; J. G. Macdonald, F.R.G.S. Hon. Member of Council and Auditor: Robert Fraser, J.P., F.R.G.S.A.Q.

On the motion of the Hon. Secretary, Dr. J. P. Thomson, a vote of thanks to the retiring Members of Council was carried by acclamation.

The President then delivered the Anniversary Address, being a continuation of the subject of his previous deliverance on the "South Polar Regions and the Work of the British National Antarctic Expedition." The Address was illustrated by a number of very beautiful Lantern Slides, supplied by the Royal Geographical Society of London. A vote of thanks to the President was carried by acclamation, on the motion of the Hon. A. J. Carter, M.L.C.

This concluded the business, and the Meeting took the form of a Conversazione, light refreshments being served.

CORRESPONDENCE.

The following correspondence having been read before the Society during the session and duly approved, was brought under the notice of the Queensland Government for favourable consideration:—

Telegraph Chambers, Queen Street, Brisbane,
29th November, 1904.

Dr. J. P. Thomson, Honorary Secretary Royal Geographical Society of Australasia, Queensland, Brisbane.

Dear Sir,—

At the last meeting of the Council held on the 17th instant, you brought up the question of "Water Conservation," which the "Brisbane Courier" in a recent leading article represented might be advantageously taken up by the Society in the way of collecting data for future use.

I suggested that one step towards the desired end might be accomplished if the Society represented to the Ministerial head of the Lands Department the advisableness of the Survey Branch of the Department taking steps to inaugurate a system of Barometrical Observations by Surveyors, with view to determine approximate elevations of places above sea-level.

These Barometrical Observations would add nothing to the cost of survey operations conducted by the Staff Surveyors of the Department, and, when the system was satisfactorily established, it might be extended to the operations of the Licensed Surveyors.

In dealing with the conservation and ultimate utilisation of water, a fairly accurate knowledge of the relative levels of places is of primary importance, and, although such approximate work as that I propose would not preclude the necessity for accurate detail surveys for particular schemes, it would be of service in the initial consideration, on broad lines, of the great question of water conservation.

For instance:—If the Government were to invite such a well-known engineer as Mr. W. Willcocks, C.M.G., who, some two or three years ago, was employed by Lord Milner to report on the question of irrigation in South Africa, he would find that the maps supplied by the Lands Department would be of very little service to him, for the reason that, except in the vicinity of railways, they furnish no information as to the absolute or the relative heights of places.

The class of work I advocate would also be of the greatest service to engineers engaged in the survey of roads, railways, etc.

I enclose under separate cover six (6) copies of a paper I have written for the Queensland Institute of Surveyors, dealing with an extensive barometrical survey I recently conducted in the Northern Burnett district on behalf of the Department of Public Lands.

I do not claim that the methods of using the Aneroid Barometer described in my paper are the best possible methods, but it will be seen that with ordinary care in the use of a properly constructed instrument excellent results can be secured.

My barometric work in the Northern Burnett added nothing to the cost of the survey, whilst, if the advisableness of adopting an extensive scheme of water conservation and irrigation, or if the construction of railways or roads were under consideration in that district, my barometer work would prove of material service to the engineer intrusted with the initiation and design of the works.—I am, dear Dr. Thomson, yours faithfully,

GEO. PHILLIPS.

Approved. Send copy to Minister for Lands, with recommendation to give effect to Mr. Phillips' suggestion.—H.M.N. 29/11/04.

Copy, with recommendation, sent accordingly.—J.P.T. 4/12/04.

Brisbane,
13th March, 1905.

His Excellency The Right Hon. Sir Hugh M. Nelson, K.C.M.G., D.C.L., F.R.G.S., President R.G.S.A., Queensland, etc.

Your Excellency,—

In compliance with your request, and in accordance with the Council's instructions, I have the honour of submitting the following remarks in favour of the creation of a Queensland Board on Geographic Names, as suggested at a former meeting:—

All who have had anything to do with the preparation of maps, charts, gazetteers, or other geographical representations, are aware of the confusion which often arises owing to the variations in the orthography of place-names. This is frequently the cause of much inconsistency, not only in official publications, but also in individual instances and public matters, it not being uncommon to find duplications of such names and the same name spelled in more than one way upon maps or in gazetteers issued at intervals of time by the different public

departments. Take, for example, "Yuleba," with two or more spellings. This variety in orthography has caused trouble and annoyance to some of our local Government offices as well as to geographical authorities and writers, who have experienced difficulty in deciding orthographic questions of importance. With the exception of the names of political subdivisions, geographic appellations in Queensland, as elsewhere in Australia, have not, as a rule, been bestowed by any formal authority. The names of natural features, rivers, lakes, mountains, capes, etc., have originally been given by explorers, surveyors, and early settlers, and these names have been perpetuated by common consent. Differences of usage exist to some extent not only in the names of natural features, but even in those of centres of population, designated by official authority. These differences have originated in several ways.

In the settled and unsettled parts of the country different explorers and pioneer settlers, ignoring the work of their predecessors, have given new names to features already named, and this has led to much confusion, and occasionally to disputes.

The transliteration of native names has been responsible for differences in spelling wherever occurring in the State, inasmuch as no two persons understand alike or render into the same English characters the obscure sounds of aboriginal names.

It sometimes happens in the case of the larger geographical features, such as extended mountain ranges, rivers, etc., that different names have been applied locally to different parts, and these names are apt to lead to confusion where not clearly defined or officially recognised.

Occasionally our State railway stations have names which are inappropriate, and do not easily conform to public usage. In the Post and Telegraph Department, too, there is to some extent a confused nomenclature of the smaller towns and villages, to which names are attached that are not popularly recognised, and there is consequently a tendency to confuse those using the Postal Service. Then there is the evil arising from carelessness or ignorance on the part of those who use the names, resulting in confusing differences, many of which appear in print and are usually perpetuated, especially in popular works and the public Press.

In modern usage a development of geographic nomenclature is recognised, and present-day requirements clearly show that there is a tendency towards the discarding of objectionable names and the adoption of pleasing ones, and towards the simplification and abbreviation of names, particularly as shown in the dropping of silent letters.

For instance, it must be admitted that such local or State place-appellations as Goonneringerringgi, Micketeebumulgrai, Toondooninanigy, and many other equally ponderous names on our maps are unworkable and out of keeping with the spirit and needs of the busy age in which we live.

At the first Inter-Provincial Geographical Conference held at Melbourne in December, 1884, the desirableness of effecting improvements in the nomenclature of Australian Geography, by abolishing inconvenient and misleading synonymy and substituting unambiguous names, was considered. The late Baron Sir F. von Mueller, in the course of the discussion, referred to a long list of names, which he had prepared from the map of Australia, in which the same names were found repeated in many instances, some being used as many as nine times. He pointed out the inconvenience of having so many names alike for rivers, towns, mountains, and other geographical features on the map. As far back as 1885 the famous British Royal Geographical Society, London, being "impressed with the necessity of endeavouring to reduce the confusion existing in British maps with regard to the spelling of geographical names . . . . formally adopted the general principle which had been long used by many," in elucidation

of which there was established the Society's well-known system, detailed on the printed slips hereto attached, for fuller information and ready reference.

In the various countries of Europe, in India, Canada, and the United States of America, it has been considered so desirable that uniform usage in regard to geographic nomenclature and orthography should obtain throughout the executive departments of the Governments, and particularly on the maps, charts, etc., issued, that special State Boards have been created to deal with the matter, the decisions of such Boards being final and accepted as the standard authority in all things which come within the scope of their deliberations. Feeling that Queensland is in need of a body of the kind, I beg to suggest that the Government be strongly recommended to appoint a Board with executive authority, to which all doubtful and unsettled questions of geographical orthography may be referred. The Board should be so constituted that its organisation would entail no expense on the Government, and its personnel would consist of such representatives as may be recommended for the special work required. The operations of such a body should necessarily be governed by well-considered rules of procedure and by principles, to be hereafter formulated and adopted, as occasion and circumstances may require.—I have the honour to be, your Excellency's most obedient servant,

J. P. THOMSON, Hon. Secretary.

To bring the subject under the notice of the Government.—H.M.N. 27/4/05.

Copy with President's letter of recommendation to the Premier.—J.P.T. 11/5/05.

ROYAL GEOGRAPHICAL SOCIETY.

1 Savile Row, Burlington Gardens, W.,

December 11th, 1891.*

In 1885 the Council of the R.G.S., impressed with the necessity of endeavouring to reduce the confusion existing in British maps with regard to the spelling of geographical names, in consequence of the variety of systems of orthography used by travellers and others to represent the sound of native place-names in different part of the world, formally adopted the general principle which had been long used by many, and the recognition of which had been steadily gaining ground, viz., that in writing geographical native names vowels should have their Italian significance and consonants that which they have in the English language.

This broad principle required elucidation in its details, and a system based upon it was consequently drawn up with the intention of representing the principal syllabic words.

It will be evident to all who consider the subject that to ensure a fairly correct pronunciation of geographical names by an English-speaking person an arbitrary system of orthography is a necessity. It is hardly too much to say that in the English language every possible combination of letters has more than one possible pronunciation. A strange word, or name, even in our own language, is frequently mispronounced. How much more with words of languages utterly unknown to the reader.

The same necessity does not arise in most Continental languages. In them a definite combination of letters indicates a definite sound, and each nation, consequently, has spelt foreign words in accordance with the orthographic rules of its own language.

It was, therefore, not anticipated that foreign nations would effect any change in the form of orthography used in their maps, and the needs of the English-speaking communities were alone considered.

The object aimed at was to provide a system which should be simple enough for any educated person to master with a minimum of trouble and which at the same time would afford an approximation to the sound of a place-name such as

a native might recognise. No attempt was made to represent the numberless delicate inflexions of sound and tone which belong to every language, often to different dialects of the same language. For it was felt not only that such a task would be impossible, but that an attempt to provide for such niceties would defeat the object.

The adoption by others of the system thus settled has been more general than the Council ventured to hope.

The charts and maps issued by the Admiralty and War Office have been, since 1885, compiled and extensively revised in accordance with it. The Foreign and Colonial Offices have accepted it, and the latter has communicated with the Colonies requesting them to carry it out in respect to names of native origin.

Even more important, however, than these adhesions is the recent action of the Government of the United States of America, which, after an exhaustive inquiry, has adopted a system in close conformity with that of the R.G.S., and has directed that the spelling of all names in their vast territories should, in cases where the orthography is at present doubtful, be settled authoritatively by a Committee appointed for the purpose.

The two great English-speaking nations are thus working in harmony.

Contrary to expectation, but highly satisfactory, is the news that France and Germany have both formulated systems of orthography for foreign words, which in many details agree with the system.

The Council of the R.G.S., by printing the Rules in *Hints to Travellers*, and by other means, have endeavoured to ensure that all travellers connected with the Society should be made aware of them; but as it is possible that some bodies and persons interested in the question may still be in ignorance of their existence and general acceptance, they feel that the time has come to again publish them as widely as possible, and to take every means in their power to aid the progress of the reform.

To this end, and with a view to still closer uniformity in geographical nomenclature in revisions of editions of published maps—a gigantic task requiring many years to carry out—the Council have decided to take steps to commence tentatively indexes of a few regions, in which the place-names will be recorded in the accepted form.

M. E. GRANT DUFF, President.

RULES.

The Rules referred to are as follows:—

1. No change is made in the orthography of foreign names in countries which use Roman letters: thus, Spanish, Portuguese, Dutch, etc., names will be spelt as by the respective nations.

2. Neither is change made in the spelling of such names in languages which are not written in Roman character as have become by long usage familiar to English readers: thus, Calcutta, Cutch, Celebes, Mecca, etc., will be retained in their present form.

3. The true sound of the word as locally pronounced will be taken as the basis of the spelling.

4. An approximation, however, to the sound is alone aimed at. A system which would attempt to represent the more delicate inflexions of sound and accent would be so complicated as only to defeat itself. Those who desire a more accurate pronunciation of the written name must learn it on the spot by a study of local accent and peculiarities.

5. *The broad features of the system* are:—

(*a*) That vowels are pronounced as in Italian and consonants as in English.

(*b*) Every letter is pronounced, and no redundant letters are introduced. When two vowels come together, each one is sounded, though the result, when spoken quickly, is sometimes scarcely to be distinguished from a single sound, as in *ai*, *au*, *ei*.

(*c*) One accent only is used, the acute, to denote the syllable on which stress is laid. This is very important, as the sounds of many names are entirely altered by the misplacement of this "stress."

6. Indian names are accepted as spelt in Hunter's Gazetteer of India, 1881.

The following amplification of these rules explains their application:—

Letters.	Pronunciation and Remarks.	Examples.
a	*ah*, *a* as in *father*	Java, Banána. Somáli, Bar.
e	*eh*, *a* as in *fate*	Tel-el-Kebír, Oléleh, Yezo, Medina, Levúka, Peru.
i	English *e*; *i* as in *ravine*; the sound of *ee* in *beet*, Thus, not *Feejee*, but	Fiji, Hindi.
o	*o* as in *mote*	Tokyo.
u	long *u* as in *flute*; the sound of *oo* in *boot*. *oo* or *ou* should never be employed for this sound. Thus, not *Zooloo*, but	Zulu, Sumatra.
	All vowels are shortened in sound by doubling the following consonant.	Yarra, Tanna, Mecca, Jidda Bonny.*
	Doubling of a vowel is only necessary where there is a distinct repetition of the single sound.	Nuulúa, Oosima.
ai	English *i* as in *ice*	Shanghai.
au	*ow* as in *how* .. .. Thus, not *Foochow*, but	Fuchau.
ao	is slightly different from above	Macao.
aw	as in *law*.	
ei	is the sound of two Italian vowels, but is frequently slurred over, when it is scarcely to be distinguished from *ey* in the English *they*.	Beirút, Beilúl.
b	English *b*.	
c	is always soft, but is so near the sound of *s* that it should be seldom used.	Celébes.
	If *Celébes* were not already recognised it would be written *Selébes*.	
ch	is always soft as in *church*	Chingchin.
d	English *d*.	
f	English *f*. *ph* should not be used for the sound of *f*. .. .. Thus, not *Haiphong*, but	Haifong, Nafa.
g	is always hard. (Soft *g* is given by *j*)	Galápagos.
h	is always pronounced when inserted.	
hw	as in *what*; better rendered by *hw* than *wh*, or *h* followed by a vowel, thus *Hwang ho*, not *Whong ho* or *Hoang ho*.	Hwang ho, Ngan hwi.
j	English *j*. *Dj* should never be put for this sound	Japan, Jinchuen.
k	English *k*. It should always be put for the hard *c*. Thus, not *Corea*, but	Korea.
kh	The Oriental guttural.	Khan.
gh	is another guttural, as in the Turkish	Dagh, Ghazi.

AMPLIFICATION OF RULES—*Continued.*

Letters.	Pronunciation and Remarks.	Examples.
l m n	As in English.	
ng	has two separate sounds, the one as hard as in the English word *finger*, the other as in *singer*. As these two sounds are rarely employed in the same locality, no attempt is made to distinguish between them.	
p	As in English.	
ph	As in *loophole*	Chemulpho, Mokpho.
th	stands both for its sound in *thing*, and as in *this*. The former is most common.	Bethlehem.
q	should never be employed; *qu* (in *quiver*) is given as *kw*. When *qu* has the sound of *k* as in *quoit*, it should be given by *k*.	Kwangtung
s sh t v w	As in English.	 Sawákin.
y	is always a consonant, as in *yard*, and therefore should never be used as a terminal, *i* or *e* being substituted as the sound may require.	Kikúyu.
	Thus, not *Mikindóuy*, but	Mikindáni.
	not *Kwaly*, but	Kwale.
z	English *z*.	Zulu.
zh	The French *j*, or as *s* in *treasure*	Muzhdaha.
	Accents should not generally be used, but where there is a very decided emphatic syllable or stress, which affects the sound of the word, it should be marked by an *acute* accent	Tongatábu, Galápago, Paláwan, Saráwak.

* The *y* is retained as a terminal in this word under Rule 2 above. The word is given as a familiar example of the alteration in sound caused by the second consonant.

Royal Geographical Society of Australasia.

QUEENSLAND.

DIPLOMAS OF FELLOWSHIP.

The following gentlemen have been awarded the Diploma of Fellowship under Section IV. of Clause 3, Constitution and Rules (*See page 2 of cover*) :—

Honorary :

His Excellency Sir William MacGregor, K.C.M.G., C.B., M.D., D.Sc., Hon. F.R.S.G.S., etc.

The Right Hon. Lord Lamington, G.C.M.G., B.A., F.R.G.S., Hon. F.R.S.G.S., etc

Under subsections (a and b) :—

Lieut.-Col. James Irving, P.V.O., Q.D.F., M.R.C.V.S.L.
J. A. Baxendell, Esq.
Charles Battersby, Esq., J.P.
Robert Fraser, Esq., J P.
Rev. W. M. Walsh, P.P.
E. M. Waraker. Esq
R. M. Collins, Esq J.P
Alexander Muir, Esq., J.P.
C. B. Lethem, Esq., C E

LIST OF MEMBERS.

(P) Members who have contributed papers which are published in the Society's "Proceedings and Transactions." The numerals indicate the number of such contributions.

(PP) Past President.

A dagger (†) prefixed to a name indicates a member of the Council.

Life members are distinguished thus (*).

Should any error or omission be found in this list, it is requested that notice thereof be given to the Hon. Secretary.

Foundation Members:

P1 Atkinson, J. R., J.P., Lic. Surveyor, Ipswich, Queensland.
Marks, Hon. C. F., M.D., M.L.C., Wickham Terrace, Brisbane.
P1 * Moor, T. B., F.R.G.S., F.R.S. Tas., Strahan, West Coast, Tasmania.
P1 † Muir, A., J.P., F.R.G.S.A.Q., Queen Street, Brisbane.
P33PP † Thomson, J. P., LL.D., Hon.F.R.S.G.S., etc., Hon. Secretary, Wood Street, South Brisbane.

Members:

Affleck, Thos. H., "Westhall," Freestone, Warwick, Q.
Aldridge, H. E., J.P., "Baddow," Maryborough, Queensland.
Alison-Greene, Miss Alice J., Moreton Bay Girls' High School, Wynnum.
Archibald, The Hon. John, M.L.C., "Glenugie," New Farm, Brisbane.
Armstrong, L., J.P., Normanton, Queensland.
Ashmole, Arthur, "Ilford House," Redcliffe, Queensland.
Bartholomew, T., J.P., Woombye, North Coast Line, Queensland.
Barton, E. J. T., "Courier" Office, Brisbane.
Barton, E. C., Electric Supply Co., Ann Street. Brisbane.
Battersby, C., J.P., F.R.G.S.A.Q., Georgetown, Queensland.
Baxendell, J. A., Downs Grammar School, Toowoomba, Q.
Bean, J. H., J.P., Gasworks, Sandgate, Queensland.
Beit, William, J.P., "Ascot," Toowoomba, Queensland.
Bembrick, Rev. M. L., Lufilufi, Samoa.
Bernays, L. A., C.M.G., F.L.S., Parliament House, Brisbane.
Bell, Hon. J. T., M.L.A., Dept. of Public Lands, Brisbane.
B.I. and Q.A. Coy. (The Manager), Mary Street, Brisbane.
Blackman, A. H , Chief Engineer's Dept., Railway Offices, Brisbane.
Bonar, W. M., J.P., Herberton, Queensland.
Borton, Mark W., Lands Office, Toowoomba, Queensland.
P1 † Brentnall. Hon. F. T., M.L.C., "Eastleigh," Coorparoo, Brisbane.
Brier, James F., "Royston," Albion.
* Bright, Allan B., J.P., Charters Towers, Queensland.
Bright. C. E., Actg. Deputy Post Master General, Brisbane, Queensland.

Brown, Isaac, J., J.P., Maytown, Queensland
Broadbent, Kendall, Museum, Brisbane.
Buzacott, G. H., "Fernyside," Kelvin Grove, Brisbane.
Callan, Hon. A. J., M.L.C., "Marie Villa," Mayne, near Brisbane.
† Cameron, John, M.L.A., Courier Building, Brisbane.

Cameron, Charles Christopher, "Coolabah," Ipswich.

* Campbell, A., J.P., Glengyle Station, Birdsville, Queensland.

Campbell, Norman, Board of Waterworks, Brisbane.

Carter, Hon. A. J., M.L.C., Royal Swedish and Norwegian Consulate, 35 Eagle Street, Brisbane.

Clark, James, J.P., "Wybenia," New Farm, Brisbane.

Coakes, W. J., Messrs. Finney, Isles and Co., Brisbane.

P2PP * Collins, R. M., J.P., F.R.G.S.A.Q., Tamrookum, Beaudesert. Queensland.

Collins, William, Nindooinba, Beaudesert. Q.

Corrie, Alderman Leslie G., J.P., F.L.S., Edward Street, Brisbane.

Costin, C. W., Parliament House, Brisbane.

Cullen, Mrs. M. L., "Ardendeuchar," Warwick, Queensland.

Cribb, Thos. B., M.L.A., "Gooloowin," Ipswich, Queensland.

* Crorkan, T., J.P., ————

Crowe, P. W., Darragh's Buildings, 170a Queen Street, Brisbane

Curtis, Lieut., G. A. H., R.N.R., "Gayundah," Brisbane.

Davies, Alderman John, J.P., West End Pharmacy, S. Brisbane, Queensland.

P1 Dorph, W.P.F., M.R.A.S., Hon. Sec. for N.S.W. Palestine Exploration Fund, 10 Carlton Crescent, Summer Hill, Sydney, N.S.W.

Dunsmure, Fred., J.P., "Eurella," Roma, Queensland.

Edkins, E. R., J.P., Mount Cornish, Muttaburra, Queensland.

Edwards, Edward E., B.A., "Bryntirion," Wickham Terrace, Brisbane.

Ferguson, Hon. John, M.L.C., Senator, Rockhampton, Queensland.

Fish, Alderman George South Brisbane.

Fleming, Peter, Junr., Brighton Road, South Brisbane.

* Foot, J. A., J.P., Warrinilla, Rolleston, Queensland.

Forrest, Hon. E. B., M.L.A., Messrs. Parbury and Co., Eagle Street, Brisbane.

† Fox, G., M.L.A., Yeronga, near Brisbane.

† Fraser, Robert, F.R.G.S.A.Q., J.P., Charlotte Street, Brisbane.

Gaden, E. A., J.P., Queensland Club, Brisbane.

P1 PP Griffith, Rt. Hon. Sir S. W., G.C.M.G., M.A., etc., Macquarie Street, Sydney, N.S.W.

Gross, Capt. G., Boys' Grammar School, Brisbane.

Haldane, A. C., Police Magistrate, Gympie, Q.

Hannaford,, S., J.P., Marble Hills, Glenlyon, Stanthorpe, Queensland.

Harbord, H. H., J.P., Maytown, Queensland.

† Hertzberg, A. M., J.P., Hertzberg & Co., Charlotte Street, Brisbane.

Hillcoat, Reginald E. R., J.P., Boomarra Station, *via* Donaldson, Q'land.

P1 Hirschfeld, Eugen, M.D., etc., Wickham Terrace, Brisbane.

* Hodel, F. C., J.P., Thursday Island, Torres Strait, Queensland.

Hogarth, Mrs. William, Balgownie, Cambooya, Q

Holberton, Hon. F. H., M.L.C., Toowoomba, Queensland.

* Holt, W. H., F.R.C.I., "Glanwyne," Manly Point, Manly, N.S.W.

† Irving, Lieut.-Col. J., M.R.C.V.S.L., J.P., F.R.G.S.A.Q., Ann Street, Brisbane.

Kemp, John, C.E., Engineer, Board of Waterworks, Brisbane.

† Kennedy, A. S., Hon. Librarian, Kingsholme, Fortitude Valley, Brisbane.

Kennedy, Thomas, J.P., Allora, Queensland

Kelly-Cusack, William George, P.M., etc., Ravenswood, Queensland.

Klugh, C. R., J.P., Longreach, Queensland.

† Leahy, John, M.L.A., Brisbane.

Lee-Bryce, R., J.P., Elizabeth Street, Brisbane.
Lethem, C. B., C. E., F.R.G.S.A.Q., Clayfield, Brisbane.
* Lewis, A. A., J.P., Oxley, near Brisbane.
Macdonald, A. B., J.P., Grosvenor Downs, Clermont, Queensland
† MacDonald, J. G., F.R.G.S., "Kotoro," Hampstead Road, South Brisbane.
Macdonald-Paterson, Hon. T., Brisbane.
MacGinley, J. J., Bacteriological Institute, Brisbane.
Macansh, Thos. W., "Mie Gunyah," Warwick, Queensland.
Mackie, R. Cliffe, River View Terrace, Hamilton.
May, T. H., M.D., Bundaberg, Queensland.
Mayes, Alderman Alexander, Toowoomba, Q.
* Mathieson, John, Midland Railway, Derby, England.
* McConnel, J. H., J.P., Cressbrook, Queensland.
McDonald-Terry, A. J., J.P., Kirkme Station, Clare, *via* Townsville,
McGroarty, D. C., Jane Street, West End, South Brisbane.
McIver, I. I., J.P., Bulgroo, Adavale, Queensland.
Midson, Arthur, J.P., Edmondstone Street, South Brisbane.
Miles, Hon. E. D., M.L.C., New Farm, Brisbane.
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QUEENSLAND.

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OF

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A REVIEW OF THE PASTORAL INDUSTRY OF THE STATE OF QUEENSLAND SINCE 1865.*

By JOHN CAMERON, M.L.A.

It is hardly necessary for me to state that the stage of industrial and commercial development at which communal life in this country has arrived, is based upon the primary products of the soil, of which pastoral products stand pre-eminently first—neither should it be necessary to point out that, of later years, during which period pastoralists have been regarded as the natural enemies of industrial workers, and, during which an enormous amount of State energy has been directed toward the fostering of mining, rather than towards assisting the yeoman industries, the rate of progress, which marked the earlier years of this country's history has been, relatively, much retarded. That earlier history is of intense interest to all who desire to understand more exactly the relations existing, even at the present time, among the various classes engaged in those primary activities on which the State fabric so solidly rests. In going back to the early days of Queensland, and in asking you to accompany me through the various stages of development, as regards the Pastoral Industry, I must, of necessity, be brief. In such an excursion it will be observed that many names which are now regarded merely as such, are in reality, the landmarks by which the explorer into our history must be guided, and around which the lustre of early pioneering achievement still shines.

The names of Moreton and Brisbane tell their own tale. So too do those of Oxley, Logan, Darling, Dumaresque, and Cunningham. These, and many others, are all reminiscent of the early traditions of pioneering achievements which have been handed down to us concerning the original pastoral settlers of Queensland. Some of them are attached to enormous areas, as politicians, who have canvassed such electorates as Gregory, Cook, or Burke, can testify.

*Read at the Royal Geographical Society of Australasia, Queensland, March 22nd, 1906.

From the first, it seems to have been recognised, that the future, of Queensland would develop along the lines of the purely pastoral and agricultural industries. The settlement of the country immediately surrounding Brisbane itself, that is, of the Logan, and of all that area which is now included in the Oxley Electorate, was quickly followed by extension to the Downs—named after Darling—the available lands around Ipswich having become much too small for the extending ambitions of those who wanted more elbow room for themselves, and larger pasturage areas for their increasing flocks and herds, though it was not until 1840, that their restless footsteps were turned in the direction of the Darling Downs country, and the Burnett District, after which date, a broad and beaten track was very quickly opened up.

It was about this time that Dr. Leichhardt started from Jimbour on his first exploring trip. All, familiar with the scant historical records of those days, know that the "squatters"—as they were then termed—had to face the fight which was being waged against their tenure of the land, a fight which has, more or less, lasted up to the present day, and will, in all probability, continue for many a long year.

It is very difficult to obtain any reliable records of the exact direction in which those who had embarked upon the Pastoral Industry in its many forms, began to extend their operations to those districts which are now regarded as the chief pastoral districts of the State. I am, therefore, compelled to rely very largely upon my own recollection of how these areas were occupied, when I arrived in the State in the year 1863.

My first trip to Queensland was when I accompanied my father and the late Messrs. J. and W. Crombie, with a mob of sheep purchased from the late Revd. Wm. McIntyre of "Byron Plains" near Inverell in New England. Our route lay through the Darling Downs, past Jimbour station, thence to the head of the Burnett, and on to the Dawson. Most of the country which we passed through was, at that period, stocked with sheep. From the Dawson we travelled west to the Alice River and there took up country, which was named by my father and his partners "Barcaldine." At that time the greater portion of the country in the Mitchell District was unoccupied, although on the Aramac Creek, Thompson and Barcoo Rivers, very large areas had been taken up. In the Maranoa and Warrego Districts much country had also been taken up.

With regard to the Flinders, which is really the Burke Pastoral District, the early records which I can obtain do not appear to go back beyond the year 1865. The name of the district does not appear

in the official records prior to that date, although the Darling Downs and Burnett Pastoral Districts figure, in the records of 1861, and the Leichhardt in those of 1862.

The number of sheep upon which stock assessment was paid in 1865 in the Burke District, was 54,553, but as it can scarcely be assumed that the whole of that number was taken there during that year, it is not unreasonable to suppose that there was a considerable number in the district in 1864, although beyond official ken. As a matter of fact, I know that Mr. Walker of Sydney took sheep, in the year 1864, to "Donors Hill," a station between Cloncurry and Normanton.

In 1866, the number of owners was fourteen (14), and the number of sheep 86,161. The number of sheep on each of the holdings was small, but it may be of interest to know, that in 1866 the two largest flocks in the district were those of the Castlemaine Pastoral Company, and Marathon, each returning 15,000 sheep, and both financed by Messrs. G. H. Wilson & Coy., of Ipswich.

In 1867 the number of sheep in the district increased to 198,767, but in 1868 the number had decreased to 152,602, a great rush having set in for the Leichhardt Pastoral District, where the number of sheep speedily rose to 3,000,000.

There is no record of cattle in the Flinders District prior to 1865, and, in that year, the only returns were:—

Cambridge Downs	145
Clifton	750
Denbeigh No. 1	300
Fairlight	28

The Queensland Statistics (Registrar General) make no mention of the district for 1865, but, at that time, the official records were very defective, and the above figures are those returned in connection with the Pleuro-pneumonia Fund.

The North Kennedy District has always been recognised as suitable only for the raising of cattle. The first record we have of the occupation of this district appears in the returns of the year 1865, which show that there were then in the district thirteen (13) stations.

The brothers Cunningham (Edward and Michael) and Mr. Hann and his two sons, together with the late John Fenwick, went to the North Kennedy District in 1864 with cattle, but it seems probable that much of the Flinders country was taken up with cattle lent by one pastoralist to another for a special purpose. When a license to occupy country was applied for, the application had to be accompanied by a declaration that the country so applied for, had been

stocked, and continued to be stocked in accordance with the provisions of the Land Laws then in force.

With regard to the far western portions of the State, or what we now know as the Bulloo and the North and South Gregory Districts, these were almost unknown, and it was not until about the year 1868 that any record of stock in them appears in the returns.

These few details show from what small beginnings our present pastoral industry sprang. At least it may be said, that the material progress of the country ran step by step with the development of this industry, and that, great as has been the attention devoted to mineral developments, it has never been more than a secondary factor in the country's progress

STOCK NUMBERS.

Sheep.—In 1863 the number of sheep in the State was returned at 5,672,400. By 1868 they had increased to 8,846,633. In this year, Mr. P. R. Gordon established the State Stock Department, and from that time regular and authentic statistics of the stock in the State have been kept, the figures being obtained from the returns which had to be sent in under the provisions of the Diseases in Stock Act.

From 1868 to the year 1881 the number of sheep decreased, fluctuating between 5,417,826 and 8,104,368, the average number being about 6,500,000. In the years 1882-1883, the numbers rose to 11,230,720, but owing to the drought of 1884-86, there was a fall to 9,503,168.

From the year 1886, in consequence of a succession of fairly good seasons, the numbers rose rapidly until in 1892 they reached the highest point in the history of the industry, viz., 21,728,310. From that year there was an almost constant fall, until, in 1902, the numbers of sheep had decreased to 7,213,985, or less than the number of 1870, twenty-two years previously. We are all familiar with the causes which contributed to this result. It is when we come to consider the financial loss which this reduction in numbers implies, that the importance of doing something to prevent its recurrence, as far as possible, is impressed upon every wellwisher of the State. Take the difference in income from wool alone, even at the low average of 6d. per lb. greasy, between the highest and lowest of the above numbers, and you will have a loss of upwards of £1,800,000 per annum.

Cattle.—In the Cattle section of the Pastoral Industry the statistics are also very interesting, affording, as they do, some marked contrasts to those relating to sheep.

In 1863 the number of cattle was returned at 880,392 head, and there was a gradual increase in the number, until 1894, when they reached the very respectable total of 7,012, 997. It will, therefore, be seen that there was not the same fluctuation in the cattle numbers as there was in those relating to sheep. This is, no doubt, due to the fact that cattle are more largely depastured in those districts of the State where drought conditions are not so frequent or so intense.

It must not, however, be thought that the cattle owners have not had serious difficulties to contend with. For example, pleuro-pneumonia has always been more or less troublesome, and, in some years, has been virulent, but, this disease, while it may have checked a rapid increase in the numbers, has never caused the same serious losses in cattle that the droughts have occasioned among sheep. Tick fever, otherwise known as red water, had, however, a very devastating effect upon our herds during the years 1894 to 1897.

Where cattle owners have suffered most through drought, has been in such districts as the Gregory South, part of the Gregory North, the Leichhardt, and in portions of the South Kennedy.

The result has been that since the year 1894 the numbers of cattle decreased, until in 1903 they were down as low as 2,481,717, about the same as in the year 1888.

In my opinion, one of the causes which has contributed most largely to the decline in our cattle numbers, has been the fact that large areas of purely cattle country have been resumed by the Government, under the provisions of the 1884-86 and succeeding Land Acts, on the plea that the country was required for closer settlement. In consequence, therefore, of the lack of security of tenure in the districts devoted to cattle, many properties, which were formerly used as breeding stations, had to be abandoned for this purpose.

In former days under the methods by which cattle were treated at the Meat Works, many of the by-products were lost, but now every portion of a beast, treated at any of the Meat Works of the State, is turned into a marketable commodity. This altered and improved condition of affairs, has been forced upon us by the keen competition in the markets of the world, and, the consequent necessity for employing only the most economical and up-to-date methods in the treatment of our surplus stock for export. At the present time our exports of frozen and canned meats enjoy a splendid reputation throughout the world, while as meat exporters our reputation for straight and honest dealing, is correspondingly high.

In 1894, with a population of about 445,155 persons, Queensland held 7,012,997 head of cattle, but, as I have already pointed out,

during 1903, the year in which the effects of the great drought of 1902-3 became known, it was found that the number had dwindled to 2,481,717 head. In 1904, the number increased to 2,722,340, notwithstanding local consumption, and the operations of the various Meat Preserving and Freezing Establishments. It is probable, though actual figures are not yet available, that the number of cattle in Queensland at the commencement of the present year exceeded 3,000,000 head. That the increase of 10%, after allowing for the continuous drain which is always proceeding, will be exceeded for this year, is a prophecy that is by no means too optimistic when we consider the magnificent rains which have lately fallen, which will produce an abundant supply of grass and herbage for the winter and remove all cause of anxiety for the remainder of the current year, from a pastoralist's point of view.

Horses.—The statistics in regard to this class of stock show that the numbers of horses have never been very high in Queensland. The reason for this is to be found in the fact that for many years the breeding of horses was not a profitable undertaking. Of late, however, the demand for this class of stock, has very much increased. Consequently, the outlook is brighter and more attention is now being devoted to horsebreeding. In the near future the numbers should have very materially increased.

In examining into the causes which have contributed to the losses of stock during the past forty (40) years, more especially in the western districts—one cannot help realizing that an enormous amount of money might have been saved had there been better facilities for removing stock, during periods of drought, from one district to another.

It is seldom that drought conditions are so universal as they were during the recent severe visitation, but, even in that disastrous time, there were districts in the State, to which stock might have been removed, had transit facilities been available.

As I have already shown there has been loss in the sheep section, and in wool alone, of upwards of £1,800,000 per annum, but, if to this you add the losses of cattle and sheep, then I think I would be under-estimating it, even if I put the loss at between £6,000,000 and £7,000,000. I understand that the estimated cost of constructing light lines of railway from Winton to Longreach, and Longreach to Charleville, such as that from Hughenden to Richmond, thus connecting all our main lines of railway, would cost about £600,000. Such lines would prove of invaluable assistance in removing stock from one district to another during periods of severe drought, and

would enable us to save much of the stock which now perishes through lack of adequate means of transit.

RABBITS.

Any review of the Pastoral Industry would be incomplete without reference to the rabbit pest, as next to the drought, I look upon it as the worst scourge which pastoralists have to fear. The late Mr. Francis R. Murphy, who was member for the Barcoo from the year 1885 to the time of his death in January 1892, directed public attention to the importance of making provision for the prevention of the incursion of rabbits into this State. Associated with him in this matter were the late Hon. John Donaldson, Hon. E. J. Stevens, and others. Unfortunately, their representations and warnings were not treated with the seriousness which the question demanded. In the year 1882, rabbits were not known to be within the borders of this State, but they were rapidly approaching our territory, as they were becoming very numerous in the Burke, Wanaring and north-western districts of New South Wales. After persistent agitation, authority was given in 1885 for the construction of the rabbit fence along the southern and western borders of the State. The fence was begun in 1886 and completed in 1891. This, however, was too late, as by that time, the rabbits had crossed into our territory. It is unnecessary for me to enter into the subsequent history of this pest in Queensland. Suffice it to say, that since 1886 it has been a constant source of worry and an enormous expense both to the Government and the pastoral lessee. Up to the present time there have been erected in this State nearly 16,000 miles of rabbit netting fencing.

Of this,

The Government has erected	732	miles
The Rabbit Boards have erected	5,573	,,
The Crown tenants have erected	9,480	,,

and the erecting of the fences is still going on. The estimated cost of this fencing is from £850,000 to £900,000. To this has to be added the yearly expenditure caused by maintenance, supervision, etc., which absorbs annually a very large sum of money, which could be more profitably spent in the development of the industry. I am afraid the public in our coastal and inside pastoral districts do not yet realise the importance of this question, or the far-reaching and evil effect which the spread of this pest will have upon the general interests of the community. For years they have seen the south-western pastoralists fighting desperately to keep back the swarms of rabbits which would otherwise have overrun the State. This has caused the coastal people to regard the issue as one which concerns those pastoralists only. Now the floods have come, and if I am not

much mistaken the damage to the rabbit fences will be very considerable. Even if the south-western lessees could, it is doubtful whether they would undertake the reconstruction of the fences. In many places the extra burden would make the holdings unprofitable, and they would perforce go to swell the already too heavy list of forfeited and deserted areas.

I think the greatest trouble ahead will be found in the almost impossible task of dealing with rabbits on resumed areas. I cannot see how these resumed holdings can be kept fairly clear of rabbits or prevented from becoming breeding grounds at a less cost than 3d. per acre yearly. I do not mean that this sum would be sufficient to exterminate them, but it might be enough to check any increase. Unless country is good enough to carry a sheep to two acres, it would be throwing money away to expend so much on it. This is why the unoccupied areas and resumed holdings are the main difficulty of the situation.

ARTESIAN WATER SUPPLIES.

The firs artesian water obtained in Queensland was in December, 1887, at Barcaldine. Up to June 30th, 1904,—the date of the latest available official returns,—the total number of artesian wells, public and private (known to the Water Supply Department) was 973, and the aggregate daily flow was approximately 390,847,909 gallons.

The discovery of artesian water in the western areas of Queensland has had a very marked influence upon the development and occupation of that country, as immense areas, which it was found impossible to water permanently by the old methods of conservation with dams and tanks, and through the sinking of wells, has now been occupied by large numbers of stock.

Up to the present time, artesian water has not, so far as I am aware, been used to any great extent for the purposes of irrigation, and as a matter of fact, I think it is beyond doubt that many of the artesian flows are not suitable for such purposes.

TYPE OF SHEEP WITH WHICH QUEENSLAND IS STOCKED.

The sheep with which much of the western country was stocked in the sixties were of inferior quality. Some good sheep were introduced from the New England and other districts of New South Wales, but the great majority were cull females from some of the large flocks on the Darling Downs, and those, who had taken up and stocked the large western areas of Queensland country felt more concerned about increasing the number of their flock, than in maintaining or improving the quality of the animals. At the period I refer to, five lbs. of fairly clean greasy wool was regarded as a good

average clip, but this is now entirely changed. Large numbers of high class stud sheep have been introduced, and very heavy culling has been resorted to, with the result, that the average western Queensland flock, as regards the quantity and quality of wool produced, per sheep, will compare very favourably with the sheep of any other part of Australia. The old idea that the wool of sheep bred, or kept, for any length of time in the northern or far western portions of the State would, by reason of the heat and dryness of the climate degenerate into hair, has been entirely dispelled. Indeed, the contrary was proved to be the case, as experience has shown, that the wool produced from sheep depastured in those areas becomes very fine in fibre, and light in weight, so that constant care, skill, and watchfulness, are requisite to counteract those tendencies. While on this subject, it may not be out of place to mention that, during the Brisbane Wool Sales of last year, a large line of wool, grown on one of these far north-western stations (well within the supposed hair zone), by the Messrs. Ramsay, and scoured at the Alba Works, near Hughenden, brought the highest price of the year, viz., 24d. per lb. This parcel of wool, as regards quality, condition, and general get-up, was the best I had ever seen during my forty three (43) years experience as a wool grower in Queensland, and I do not think it could be surpassed in any part of the world. Apropos of this, a rather good story is told of the late William Landsborough, the explorer. After his expedition across the Australian continent, Mr. Landsborough made a voyage to the Old Country, and during his stay was entertained by the Royal Geographical Society of London. At that meeting, Sir Roderick Murchison remarks, that he was credibly informed, the climate of northern Queensland was such that wool would very speedily degenerate into hair. Mr. Landsborough's argument against such an assumption was that, "the hair of the blacks in those districts was woolly."

I have already stated that during recent years, an immense improvement has been brought about in the flocks of western and northern Queensland. This has been accomplished by judicious selection, and the introduction of fresh and improved strains of pure Australian merino blood. The term "pure Australian merino" may appear to some as rather a misnomer, but the fact remains, that we have, in Australia, established and fixed, a type of merino sheep, which for general excellence, strength of constitution, beauty, and value of fleece, is not surpassed, if equalled, in any other part of the world. The type we have succeeded in fixing is largely the result of climatic conditions and general environment, but the characteristics of the sheep may vary considerably, according to locality,

climate, pasturage, etc. There can be no reasonable doubt that the high class Australian merino, as we know it to-day, is, in every respect, superior to the merinos which were introduced from the Cape of Good Hope by Captain Macarthur in the year 1804, and somewhat later on by the same gentleman from the flock of King George the Third.

At this stage, I may be permitted to digress slightly from the main object of my paper in order to give you a brief outline of the origin of the Australian merino.

There can be little doubt that the Australian merino has descended directly from the Spanish merino, as Captain Macarthur is known to have imported several true Spanish merinos, and these sheep were actually the nucleus of his afterwards celebrated flock.

During the eighteenth century, so jealously was the fine wool trade guarded by the Spaniards that it was a capital offence to export any merinos from Spain, but, owing to the services rendered by England to Spain, a present of a few animals was made by the Spanish Monarch to King George the Third,—there being no warrant against the distribution of sheep in other lands. His Majesty sold several, which were purchased by Captain Macarthur in 1804. The highest price given for them being £44 per head.

Going still further back in tracing the origin of the merino sheep, the question arises, whence did the Spaniards obtain their merinos? Most probably, from the North of Africa. The enterprising Phoenicians and Carthegenians spread the sheep of Syria along the whole of the north coast of Africa, and in process of time these sheep were introduced into Spain by the Romans and the Moors.

The name "merino" has several translations, some saying it is derived from the name of a Roman officer, "Merinas"; others, from the word "Merinas," meaning "Mariner from over the seas"; the modern origin is from the Spanish "Merino" meaning "traveller or fugitive."

I trust it will not be regarded as foreign to my subject if I offer a few remarks regarding the lines to be followed in selecting or judging sheep for wool or carcase purposes, as the case may be.

For example, if one intends to produce mutton, the main object should be to obtain a sheep that will show conformation and constitution to a more pronounced degree than wool producing capabilities. So important is the consideration of form, that some authorities (with whom I heartily agree) assert that mutton sheep should be judged when entirely divested of their fleece, for the production of wool and mutton are two distinct branches of the pastoral industry. It is also a recognised fact that the best result in regard to either one

of these branches of the industry, cannot be attained, without a sacrifice to the other.

In order to prove this point, one of the great features in the production of wool is to breed a flock even, in regard to one another, as well as in evenness of covering, on each individual sheep. This feature can be obtained in a merino flock by careful management to the extent of say four (4) counts, that is, the wool ranging from 60's to 64's ; but in the case of crossbreds, the wool should range from 40's or even lower, to 56's, so from this it can be seen that when breeding crossbred wool, one cannot determine with much certainty what will be the quality of the progeny in regard to its fleece. In the selection of sheep for the production of wool, the fleece or covering, must receive very great consideration, as must also the constitution and form of the animal. Taking the two main points of wool sheep as fleece, and constitution and form, we must place constitution and form first, while covering will come second, for it is obvious that however good the fleece may be, if the animal shows signs of a week constitution, the covering will be of no avail, the progeny being unable to withstand the change of seasons and the hard times experienced during the life of the flock sheep. Further if the sheep be lacking in form, when its possibilities as a profitable wool producer are exhausted, a very poor return will be obtainable for the carcase.

In the Show Ring, too much attention cannot be paid to the covering of a sheep, but it is a lamentable fact that many judges are carried away by the splendid wool bearing qualities of an animal, and neglect that most important point of all, con titution.

The following are some of the primary points to be considered.

1. Barrel	round and lengthy, ribs well sprung.
2. Back	short, level, strong, and straight.
3. Neck	short on top scrag , deep when viewed from the side, and long below, strongly set.
4. Shoulders	should be broad, not above the level of the back.
5. Chest	wide and deep.
6. Loin	broad and strong.
7. Head	in proportion to the body—a large head denotes a lazy disposition, a small head is a sign of delicacy ; forehead slightly arched.
8. Muzzle	clean, free from dark spots, and covered with a soft, short, fine, velvety hair, with two or three distinct wrinkles from each side of the mouth, nostrils wide.
9. Legs	should be short, straight, and set well apart, the twist well rounded—the appearance of four straight sticks attached to a barrel.

10. Flank	deep and straight.
11. Quarters	long and full.
12. Eyes	bright and placid, free from spots.
13. Ears	should be white, soft, thick, wide apart, and covered with a short curly wool.
14. Thigh	long and broad.
15. Hoofs	clear in colour.
16. Horns	well set, not too close at the base, taking a regular curve, showing distinct regular corrugations, becoming finer towards the points, room between the horn and cheek to allow of a free growth of wool. Free from stains ; of a dim colour.

THE COVERING.

DENSITY	The wool to lie close and thick all over, especially on the back.
EVENNESS	The wool should be of an even quality, that is, not too great a variation between the finest part (shoulder) and the strongest part (britch).

From natural causes some variation must occur, the acme of breeding (an even fleece) having not been attained. The less the contrast the better.

These two points are of paramount importance in the judging of sheep. The other points following are of secondary importance.

FINENESS	In regard to the type of sheep it is intended to represent.
LENGTH OF STAPLE ..	Ditto.
SOFTNESS	Is a very important point in all wool. Softness give to wool, or I should say, helps the spinning quality, and manufacturing utility of the wool.
FREE GROWTH	Implies that the fibres present an uninterrupted growth, not cotted or webbed in any way, and proves a good taring wool.

By the term " taring "—the suitability of the wool to give a big return of yarn to a small proportion of waste.

FREEDOM FROM KEMPS, OR FOREIGN HAIRS	To be looked for on the shanks and face.
COLOUR	Either brightness or lustre in regard to breed.
YOLK	Should be fluid and should be such as to help the softness of the wool, of a good healthy colour, white or pale yellow.

There are many important facts connected with this industry and its relations to the other industries of the State, which I should like to refer to, as the information concerning them is both voluminous and interesting, but within the limits of an address of this character, it would not be impossible to include them. I trust,

however, that what I have laid before you has been instructive, and not unworthy of the Society, which I have the honour of addressing.

In closing my remarks I desire to acknowledge my obligations to the following gentlemen,—Messrs. H. C. Shaw, P. R. Gordon (late Chief Inspector of Stock), Drewe Wilson (Instructor in the Technical College), the Department of Agriculture and Stock, the Department of the Hydraulic Engineer, and others, from all of whom I have received very kind and valuable assistance in getting my facts together.

THE WONDERS OF THE NOR'-EAST.*

By RANDOLPH BEDFORD.

THE Depths of the Pacific send a current from the East—a current which rushes Westward past the Southern extremity of the Barrier Reef—that coral wonder of the world—and strikes the Queensland coast at Broadsound, where it piles up 29 feet of local tide. There the current splits—half of it goes North within the Reef for 1,300 miles, half goes South to be blessed by Southern-bound shipping for its three knots of help, and at Gabo Island goes East again to whence it came. But it is not the same water; heated by the North, it goes South and East again, leaving a track eleven degrees warmer than New Zealand waters of the same latitude.

My definition of Heaven is North-east Australia between May and September—the Queensland coast for a thousand miles within the Reef in the so-called winter. I have gloated over its memories in the bitter middle of the year in Melbourne, and in the end have rushed away from mere duty to its romance; and last January, in Glasgow, the smell of the Northern Sea, the colour of the great Reef, the opulence of the Northern jungles were so tangibly present that my homesickness broke out in verse at least once a week; seeing, instead of the chimney stacks of South Melbourne, the mighty cedars of the Barron rising through the creepers of the jungle; and to my ears the reverberance of the Broomielaw drowned by the thunders of the Reef.

From Broadsound to Cape York the days and nights, the sea and sky, the hazy land, the ship that rarely rocks its keel an inch and never closes its ports for a thousand miles or more, are all expressions of tangible romance and of visible enchantment. The scented breath of a bush fire from the land, the tropic scents of the tide-bared Reef mingled with the odours of towns that seem to be made of pineapples; distant reefs lying the sea like shadows, the mountains of the Main blue in distance, the lazy inner sea lipping 1,300 miles of cay and coral; the water shining like a taut bowstring under the sun, and by night a silver plane that bears the ship as placid as a resting gull.

The coast is full of the romance of effort and endurance: Cook and his coral-plugged and leaky ship beaching in Endeavour River after the anxious days of Cape Tribulation; Bligh and his boat of the "Bounty"; great Matthew Flinders; and Lizzie Watson,

*Read by the Hon. Arthur Morgan, M.L.C., Vice President, at the Royal Geographical Society of Australasia, Queensland, May 16, 1906.

who agonised on a waterless cay and saw her child die before death mercifully came to herself.

The Man and Wife Rocks and The Child, east of Great Keppel Island; Herald's Prong, and Thirsty Sound; Half-tide Rock and Gar-fish Cluster, have each their story of effort, achievement, and failure. And where recorded romance is not, the eye supplies it at every point on this marvellous coast: The lion shape of Pentecost and Jesuit Point; the Cid; Orpheus Isle and Miranda Point; Townsville, Tower Hill, and Magnetic Island; Bowen and its white beaches of skirmishing, porcelain-blue soldier crabs; Cape Bowling Green; and Whitsunday Passage and Hinchinbrook Channel, which, like Albany Pass and Mourilyan, have been stolen direct out of Paradise.

It is an easy possibility to see these wonders without being an hour at sea on an uneven keel. From any point in the South the Reef can be reached by railway, and without a foot of broken water; and from Keppel Bay to Thursday Island there are but a thousand miles of mill-pond calm. The railway track from Brisbane is full of interest of a different sort; Beerwah, Ngungun, Coonowrin, and Tibberawockum—mountains which are not so fearsome as their names; Bundaberg and the sugar-planters of the Burnett; the fine city of Rockhampton, and n ar it Mount Morgan, one of the world's mining wonders. And, from Keppel Bay, a sea dead but for its tides; the rice-white sand on mainland, beach, and cay—the steamer so steady that the web-toed gulls stand flat-footed on the jumper stay as the engines drive her at a twelve-knot gait through the sap-green water.

Civilisation has done much for Cairns, but not too much. The plateau beyond it, the rich alluvials, the dense vegetation of ferns and orchids, the tangle of immense cedars, lianas, and wild banana have not been improved out of existence by the actors in the wondrous story of persistent courage represented in the scaling of the Cairns Range by the old tracks. The Barron Gorge and the Falls are still as wildly beautiful as when Captain Cook sailed almost under the shadow of Bellenden-Ker a hundred and thirty-five years ago, and named the arm of the sea by Cape Grafton—Trinity Bay. The traveller now scales the wall of mountain luxuriously in a train, skirting the kauri-grown gorge of the Barron, and almost splashed by the spray of Stony Creek Falls; leaving Cairns sitting in the wreck of its jungle a foot or so above high-water mark—sweltering in its sun heat in the summer, when it achieves 12 or 15 feet of rain, but merely warm in the winter, and peculiarly healthy

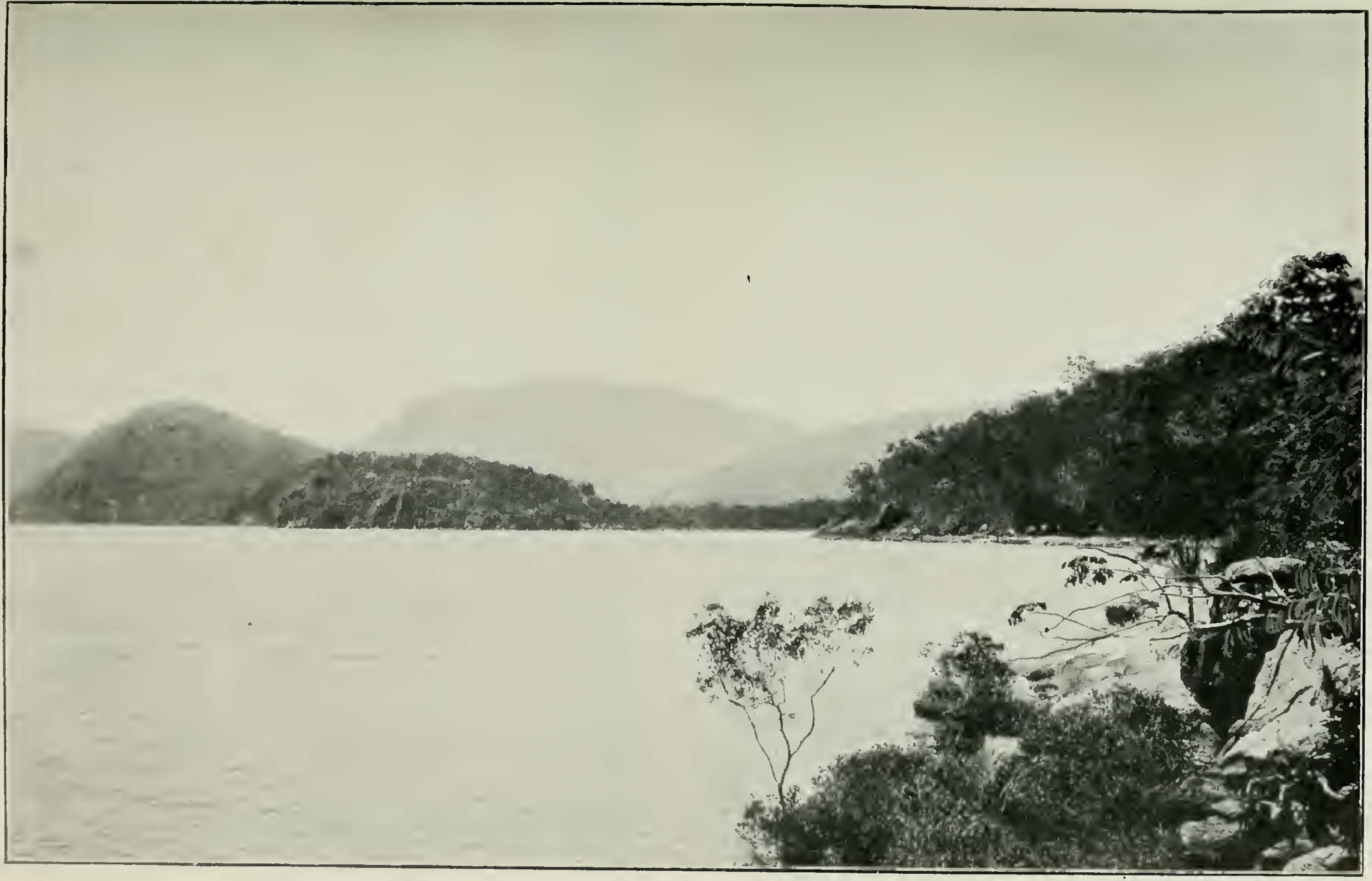
at all times—and borne swiftly through many tunnels and around curves ramparted with bananas and ferns.

Once on the tableland at Kuranda another new world begins for the Southerner. He has had the wonder of the Reef passage, and the romantic new experience of a tropic town in his own country ; and now comes to him the marvel of the Atherton Scrub. He has seen the Barron Falls at Kuranda—so indescribably magnificent that only a bad craftsman would attempt their description ; a quarter of a mile of mad water, leaping 800 feet to a gorge, wandering reptilianly to the sea—a serpent in diorite ; and half-way down the descent of the Barron River into the gorge a central tooth of blackened rock, and on it a tree growing calmly in all that hell of tortured suds and water

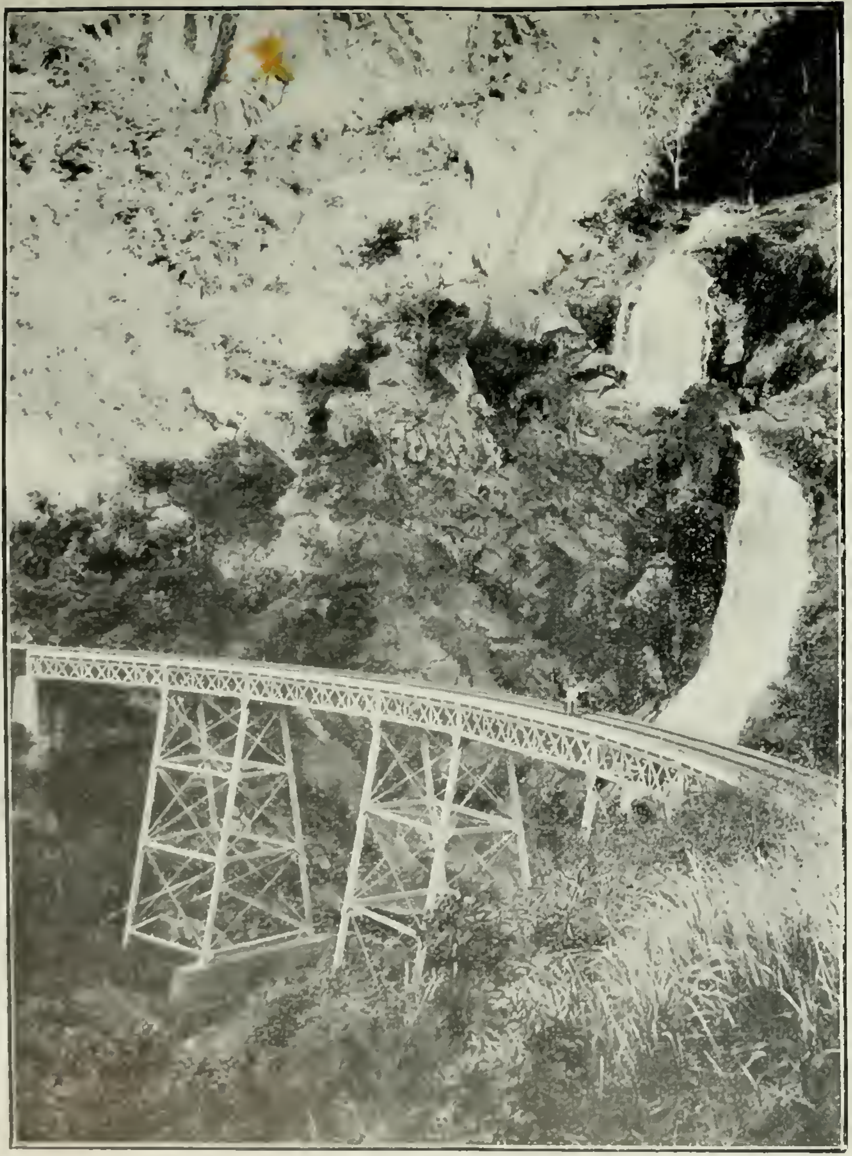
To the Falls has succeeded typical North Queensland plain country—granitic, ant-hilled, sparsely wooded with gums. The railway forks at Mareeba—the Northerly branch goes to Chillagoe and its rocks, caves, and other lime formations of great beauty—Balancing Rock, the Leaning Rock, the Lizard's Head, and the caves at Girofla ; the Southerly railway strikes over an elevating plain of basalt, and, in 18 miles or so, reaches its terminus at the Atherton Scrub. There is absolutely no more beautiful forest nor any richer soil on earth than this. I lived in and near this Atherton forest for a year or two, and to me its beauty is as fresh and alluring as when I first saw it, nine years ago. There are cedars and crow-foot elm and silky oak—rosewood and satinwood—ferns, orchids, and flowering vines carrying a hundred feet of blossom from ground to summit ; banyans of marvellous extent and decorative beauty. Lake Eacham, the unfathomable, which was once an active volcano, and is now a tarn of violet water in the mountains, is only two hours away ; Herberton, with its climate of Southern Tasmania, is but a dozen miles distant by the coach road across the range.

In the North-eastern State—the richest and most beautiful of all the Australias—the very length of coast line and the number of excellent harbours have insisted on a policy of decentralisation unknown to the South. As the result, you have not one railway system, but five, so that the voyager of the Reef may see the back country of Bowen ; of Townsville—Charters Towers to far west on the Cloncurry road ; Cairns to Chillagoe ; Cooktown to Laura. And then the tramways of local government link the sugar lands with the sea at Lucinda Point, the Johnstone, Cairns to the Mulgrave, and at other points. In a round trip of a month from Sydney

S.S. PALMER PASSING HAYCOCK ISLAND, HINCHINBROOK PASSAGE.



A BIT OF HINCHINBROOK PASSAGE.



STONEY CREEK BRIDGE AND FALLS, CAIRNS RAILWAY.

GLACIER ROCK, CAIRNS RAILWAY.

A BIT OF WHITSUNDAY PASSAGE.

THE FAMILY GROUP, NORTH OF KINCHINBROOK.

HAYCOCK ISLAND, HINCHINBROOK PASSAGE.

THE BLUFF, HINCHINBROOK PASSAGE.

or Melbourne, the tourist can secure a knowledge of the Reef and the richness and the beauty of the mainland ; a few weeks longer would make that knowledge intimate.

The Barrier itself is practically unknown ; yet its value economically, apart from its value in beauty, makes it one of the great assets of Australia—neglected though it be at this moment. It produces a hundred thousand pounds a year or so to Queensland trade, and it has the potentialities of a million. The area inside the Reef in Queensland waters is 80,000 square miles ; it is full of raw wealth : pearl-shell and corals, fish and beche-de-mer. It has been made a safe highway for all the ships of the world on the Eastern route to the North ; it gives to Australia—the land of big things—the longest stretch of pilotage in all the seas.

All its reefs, and shoals, and pools, and all its depths, are full of life ; the channels and lagoons within the coral are instinct with bewildering beauty. All the corals are there—not the dead, bleached skeletons of corals which we see in glass cases flanked by a stuffed and preposterous blow-fish ; but with all the brilliance of the living coral animal, who is no more an insect than the shark is an insect. The living reefs have all the colours of the tropics ; the lavish hand which tints the painted finch, and splashes pigments on the bird of paradise, and paints the parrot-fish a livery of scarlet, black, and grey, has worked upon these corals ; dyeing them in colour schemes the Southern eye will at first sight call impossible. The great violet bouquet shaped madrepora ; coral in delicate spikey flowers—the branches of buff, and the petals of magenta ; staghorn corals tinted in millionous variants of brown, green, yellow and lilac ; the madrepora rosaria—pale lemon at its bases and flesh pinked at the tips ; labyrinthine coarsely toothed corals—their ridges golden brown, their valleys myrtle green ; corals of pale pink, purple, brilliant rose, and blue. A tongue of reef—its two masses split by a fathom channel awash at dead low springs—growing slowly through its thousands of centuries, from the symmetrical corallum, a few inches wide, to this tremendous marvel ; its growth on its axis finished ; and after a million years of action still increasing on its periphery—the finest illustration extant of the beauty of all prudent energy.

Carbonate of lime can be a dead and ugly thing ; here on the Barrier it is a thing of infinite loveliness. Corals shaped like skulls, and therefore called Brain Corals, having the freaks of cerebral markings and giving their name to the peculiar Skull Island, which looks like an ancient battle-ground of low-grade types, the white skulls shining in the sun ; corals corrugated like alligator skin ; asteroids

or star corals; the giant anemone and an attendant galaxy of sea-stars; the frills and furbelows of the clam shell—ultramarine, and peacock-blue, and green; spotted in turquoise and barred in black; corals, shrimp-pink with yellow terminations; cup corals, convoluted and long-stalked; corals in large ovate masses, looking in the light-green water like a flock of sheep in an English meadow in early spring; corals like cauliflowers in shape and deep violet with cream edgings for colour; the nodular masses of organ-pipe coral; the corals of Dog Reef, near Port Denison—shaped like a swimming dog; the branching corals of the Madrepore Lagoon; all growing joyously in the opaline water, which is at once the mirror and the shield. All the beauty of form of the prepared coral is but the bleached skeleton of the brilliant life of the Reef.

In the pools between the reefs grows the broad-bladed sea grass; here is the favourite grazing ground of the dugong—that sea pig which was the Siren of the Ancients and the mermaid of the later sailor man.

No man who has once seen the life of the Reef may forget it. The brown wall of Florence and Ghiberti's doors, and the Boboli Gardens; the Duomo of Milan; the Grand Canal and Maria Assoluta of Venice; the Garden of the Pincio in Rome; Pichi Richi Pass in the lake country of South Australia; the Tower of London Rock at Chillagoe; the Barron Falls; sunrise in the Indian Ocean—no man may forget *these* things. But, if he could, the knowledge of the Barrier Reef must stay in the memory, painting itself in brilliant primary colours and with all forms of the bizarre.

The deep indigo of Heliopora coral as the foot snaps it; a giant anemone two feet in diameter, brilliant in the shallow pools of three-quarter ebb, and a fish and a lobster as brilliant as their host living on friendly terms with the anemone and swimming in and out of its mouth, their one attendant a white transparent prawn, spotted in yellow and red; a star-fish of dappled Antwerp blue and suckers of chrome; clam shells growing to a length of ten feet and a weight of a ton—Captain Cook called them Giant Cockles, ate of some small ones, and saw that they were good; and all the miracles of lime growing at a rate estimatable by the fact that the coral of the Quetta Rock grew up to striking distance of the ship in the space of forty years.

One of the most important industries of the Reef is beche-de-mer or trepang fishing. The trepang are present in the pools between the reefs in all shapes and colours and varieties, and generally visible at low water, lying like great black cucumbers on the sand. They are collected during low tides in the new and full phases of the moon.

Boiled, dried, and smoked, trepang is worth up to £90 per ton. Truly is our land the land of plenty. The European millionaire pays thousands of pounds to buy at Monte Carlo the thing we get here for nothing—sunshine and blue skies; for the Casino is but the sauce piquante of the feast. The magnate of England buys turtle or trepang soup at seven and sixpence a plate, and along the Queensland coast you find it and other delicacies of our tropic seas included in the half-crown meal.

Along the Reef are many islands—in itself each a Pacific Cosmos. The island beaches are of corals and shells with a central belt of trees and pandanus. On the lee side the coral shoal sloping gently seaward; on the weather side a two-mile half-circle of reef enclosing a lagoon, thickly populated with shark and turtle. Noddies, terns, gulls, herons, and curlews, shrieking above the surf-noises; the reef-pools filled with brilliant fishes—ultramarine bodied and yellow finned; black with a single electric blue stripe; big blue-spotted sting rays; the grotesque tobacco-pipe fish—a weak swimmer and easily captured—of golden and azure spotted brown; sheltered in these great coral basins that spring suddenly from unfathomable depths. The Torres Strait pigeon—beloved of the sportsman, in a left-handed kind of way—nests in the forked branches of the mangroves; there are scrub hens and green bee-eaters, whose throats are a vivid blue, and who wear two long narrow feathers in their tails.

On the islets or the mainland, the man of the gun will find the sportsman's paradise; in the waters within the Reef, the fisherman has waiting for him the king representatives of salt-water life—the government bream, the parrot-fish in shoals of a score strong, the barramundi, the silver bar fish, and the king fish. If he wants excitement, there are the great reef-eels; the skate, which is merely a superior-fleshed kind of flattened-out shark, and is a fine food wasted in all this spendthrift plenty; the horned ox ray, which measures twelve feet across its expanded fins; and the dugong, which sits up in the water and nurses its young like a woman, but, by reason of the stupid surprise which is the permanent expression of its fat, vulgar face, looks not like a mother, but a Missus Gamp discovered in the act of embezzling the invalid's brandy.

The waters of the Reef are full of a gorgeous waste of food the immense shoals of herring, mackerel, anchovy, and pilchard, of schnapper, bream, rock cod, and giant herrings, live and swim and spawn, and die—and we still import, dried and in tins, the inferior fishes of colder seas.

Turtle—the green edible, the tortoise-shell variety, and the red and yellow backed hawk's-bill—are all here, and come ashore at every cay to lay their eggs ; and the curiosity of all this wonder, a delicacy of the outpost islands of the Reef—a small marine worm known as the Palolo—is recorded as appearing in millions for two days only in October and November, the day before, and the day on which, the moon enters her last quarter. This phenomenon is common in the further South Pacific.

Two days before this last lunar phase, the natives of the islands assemble in canoes ; next dawn millions of worms appear on the surface, discharging the milt in white streams as they swim. It is the function of the wedding of the milt. During the three hours of appearance, the canoes are loaded with them ; they are eaten raw or baked in leaves of the breadfruit. Once known, the gourmets of the old world will pay fancy prices for the Palolo ; and commerce will batten on this Marriage of Nereids.

They are all unforgettable—the divine air, the opulent warmth, the splashed colours, and the soft waters of the North ; the glove and lady's finger sponges growing in the brilliant copses of coral ; fish who have been to China for their form and studied Japanese art for their pigments ; finny arabesques and curves of green and red, salmon and black, grey and orange, blue and yellow ; fish who are all protective fin and tassel ; aldermanically stupid fish, with a score of long brown pennants waving from their heads ; mad fish, with long retrousse noses ; tasselled, banded, striped, speckled, barred, spotted fishes, each painted like a Carpentaria finch.

There be Australians who do not know their country ; who have no conception of the luxurious North ; and who pursue the tropics to Colombo at great cost—suffering the seas of the Bight and the oppressive ten days across the stale greasy swell of the Indian Ocean to Ceylon ; when, at half the expense and in luxurious ease always, North Queensland and the wondrous Reef and the beauties of the Main lie awaiting them. The round trip to Cairns or Cooktown is a matter of an easy month ; if time does not tie the tourist, there is another new world in Torres Strait and its islands ; a polyglot polychromatic world of pearlers and Binghis and trepang fishers, —and all the new and interesting native peoples of North Queensland waters—of the Three Sisters and Saibai, of Darnley and Nagheer. I know Australia better than most Australians. If there is one place more than another that clinches my belief in our country as the finest of the earth, it is that land of opulence and beauty—the Magic North.

SOME ECONOMIC ASPECTS OF GEOGRAPHICAL SCIENCE CORRELATIVE WITH THE EVOLUTION OF CIVILISATION.*

By Alderman JOHN CRASE, J.P, Mayor of Brisbane.

YOUR EXCELLENCY, LADIES AND GENTLEMEN,—

I greatly appreciate the honour, as Mayor of the City, of extending to you on behalf of the citizens a hearty welcome. I have also to thank you for your kind acceptance of my invitation to commence the celebration of the twenty-first anniversary of the Royal Geographical Society of Australasia by assembling here this morning. Having reached your twenty-first birthday as it were we should, I think, all strive to make it the beginning of a new and more progressive era in the history of the development of the Society, which I take to be one of the many offshoots of the Royal Geographical Society founded in the Mother Country in the year 1830 by Sir John Barrow, Sir Roderick Murchison, Sir John Franklin, and other learned and distinguished scholars. It is when types of such exemplary men as I have mentioned become fired with a noble enthusiasm to leave the world better than they found it, and set to work to establish institutions for promulgating by group action the principles and teachings which they wish to see implanted in the minds of their fellow beings, in the hope that thereby they may advance civilization, and lead mankind to the higher life they have in view, that society progresses, and civilization develops. If there is one distinguishing feature of human progress that stands out more conspicuously than another it is that all improvement and development and all progress have moved in groups by the establishment of institutions, notwithstanding that the great epoch making periods of the world are due to the genius, energy, initiative, and resource of a few great men. The reason for this is, that the individual cannot stand alone.

Permit me now to observe that your worthy Secretary, Dr. James P. Thomson, suggested that, in addition to a formal reception, I should, as a member of the Brisbane Branch of the Society, make a few remarks by way of introduction to the important and interesting matters that are to be deliberated upon during the week.

It occurs to me that perhaps the most important subject that can engage our attention at the present time is the Economic aspects of Geographical Science correlative with the Evolution of Civilisation, because there is little question among modern thinkers that

* An Address delivered at the Mayoral Reception in Commemoration of the 21st Anniversary of the Royal Geo. Socy. of Aus., Q'land, June 26, 1906.

the economic interpretation of history is the true method of reading the past experience and progress of the human race, and, that the basic conditions which render the growth of ethical ideas and broader views of human life possible, are the changed economic life and the increased material welfare of the people. The struggles which were so numerous during the past 50 years were unmistakably more economic than political. The present struggle known as the labour movement is a demand for economic betterment and greater advantage in the distribution of production by group action. Historically speaking, the term "Economics" was first used by Aristotle, who meant the economics of the household, because, in that patriarchal stage of society the family was the real group. With the later development of political institutions, however, the term "Economics" was used as applying to the state, and took the name of political economy. The development of industry, and the progress of civilisation, during the nineteenth century, have caused the subject to be greatly expanded, and the term now includes not only the economy in the administration of Government, but the economy of the production and distribution of wealth and social welfare of the people. The two causes which above all others have gradually modified the character of "Economic Science" are, the growing importance of historical studies, and the application to society of the idea of evolution. In using the word "science" in this connection, let me observe that John Stuart Mill in his system of logic explains that "any facts are fitted in themselves to be a subject of science which follow one another according to constant laws."

Of the two causes I have just mentioned, history was the first to make itself felt, and in the hands of Roscher, the distinguished German philosopher and economist, we have it laid down that—"The aim is to represent what nations have thought, willed, and discovered in the economic fields, what they have striven after and attained, and why they have attained it." He also laid down—"That it is a principal task of economic science to show how and why, out of what was once reasonable and beneficent, the unwise and inexpedient has often gradually arisen." In this connection permit me to say that students of history and political science, as well as scientific investigators, are coming more and more to recognise the fact that the evolution of ethical standards and political ideas, and even religious conceptions, such even as the "Higher Criticism" we hear so much about, have their rise and growth in the economic condition of the people. Archaeological investigation, and historic research, have demonstrated that all we know as modern civilisation, all that we now regard as moral and spiritual advancement,

has been developed with the progress of the race from the most primitive forms of social life and economic existence. With every stage of its advance, moral standards, and religious and political institutions, have been modified, and, if long enough periods are taken for comparison, they have been practically revolutionised. Whether we view human experience from history back through the ages, or compare the different stages of civilisation now existing in the world, we are forced to the conclusion, that, in proportion as the economic and material welfare of the people are simple so are their moral conceptions crude, and their religious ideas and political institutions dogmatic and despotic. The theory held by Kant, and adhered to by Sedgwick and others, that the inward sense of conscience is a supernatural and unfailing arbiter of conduct, is historically and scientifically shown to be untenable. The law of evolution, which is simply the law of growth, conclusively shows that all the characteristics of refinement and culture, and civilisation, are the outcome and consequence of economic and social experience. It is equally well established, that the most earnest, honest, and conscientious conceptions of right and wrong have changed with the changing conditions, and grown with the expanding experience and greater development of society. Right and wrong are simply qualities of conduct, the effect of which is either good or bad. We call that good only which tends to preserve and increase the aggregate of human happiness, we call that bad which tends to increase unhappiness, or prevent the increase of happiness. The effect of conduct on human happiness is manifestly a social fact, it cannot exist outside of society Without doubt the great impelling force in all this economic transition which continuously leads to a more complex social life, is "Human Progress." Primarily, the law of progress may be regarded as the law of new desires, which spring from association and contact with new social experiences, but it has the peculiar characteristic of always bringing the bad with the good. Agreeably with this view, many eminent writers, who regard mankind in society as an organic structure, and look upon society in common with all other organisms as being governed by constant laws that are bound within an impassable circle, have affirmed that the essential principle of the great natural law of "the struggle for existence," which has raged from the beginning of time in the formation of the earth, and among plants and animals, also exists among men in society. The universality of the law of the "struggle for existence," I venture to say, can be seen in our every day life, in the fact that workmen are struggling for better conditions and higher wages on the one hand, and, on the other, the public who are the consumers are demanding lower

prices, whilst capitalists and inventive geniuses strive with all their might to meet the demands of these contending forces. And let us bear in mind that it is inevitable that this tremendous process of all round sweating, and "struggle for existence," is liable to be fought out as long as self interest reigns supreme in the human heart. The idea that human society is governed by natural laws, like the physical phenomena, can be traced as far back in antiquity as when that great philosopher, styled by Comte "the incomparable Aristotle," flourished, and that profound thinker and economist, Montesquieu, is considered to have rendered to society immortal service by his enforcement of that doctrine in his "Spirit of the Laws," a work of two volumes which was published in the year 1748. In reducing the phenomena of human character and of social existence, to natural laws like the physical phenomena, Comte separates the collective facts of society and history from the individual phenomena of biology, then he withdraws these collective facts from the region of external volition and places them in the region of law. Whenever we inquire into the merits of a public policy, for instance, we find it to be the crystalisation of public opinion. In the making, public opinion is a feeling growing out of experience, it is an effort of the mind to remedy some evil, or increase some good, hence it is always feeling by expression and repression, and so it goes through a process of evolution, which is accepted and converted into public policy and made law. Public opinion always ranges itself in two general groups, and they are usually opposite at any given time. When history began to be studied in the light of philosophy, and human experience was studied from the view point of social law, it was discovered that the changes in human ideas and conduct, and the structural institutions of society are not due to accident or caprice, but are the result of a general social law. If people have different standards of life and conduct, different ideas of religion and of the universe, it is the result of different experiences in different economic and social conditions. The different standards of moral conduct or social justice are not in the least due to the difference in the honesty or sincerity of purpose, but wholly to a different conception of right and wrong, and the conception of right and wrong are governed by the state of society. It is to be observed at this juncture, however, that believers in the doctrine of an orderly evolution of society are by no means agreed as to the influences and causes that are at work to which progressive civilisation is to be attributed. Some of this school of thought profess to be able to trace the universal form which characterises the process of existence and of mind to the progressive revelation of spirit as conceived by Hegel. There are others of them who believe imp-

proved conditions to be the outcome of the growth of humanity, and to the discovery of the laws of phenomena, as taught by Comte, while another section believes that human progress is attained by the adaptation of the social organism to its environment, as propounded in the philosophy of Herbert Spencer. But, notwithstanding this diversity of opinion, the history of society reveals the fact of an orderly development and continuity of change, lifting mankind from a state of barbarism to civilisation, and from the family and tribe to organised governments, through which the control of man over man is established by an intelligent and patriotic obedience to positive law. Now, it is claimed by political economists, that just as the history of society discloses an orderly development, so also there has been correlatively an orderly development in the history of what men have thought concerning the economic side of life, for in all periods of civilisation they have occupied themselves with the creation and distribution of wealth, conformably of course with the ideas and customs of society that under contemporary conditions prevailed, indeed it were impossible for employment to be extensively carried on, or society to hold together, without maintaining some notion as to the right way of working, and the most fitting methods for attaining the results a nation desired. This brings us to the consideration of the probability that a knowledge of economic science, and the evolution of civilisation, will one day be as necessary to the politician and statesman as other sciences now are to the inventor, for, of all the arts of life, that of government or statesmanship, with the complex machinery of means and ends which in these later days it involves, is the only one that is not able to call some corresponding science to its aid, but still remains tied to a haphazard rule of thumb, in which men's chief stay is the vague and general hope that, if they do the best they can, providence or fate will bring them out right in the end. Navigation, for example, with its pole-star, compass, and charts, has been for ages dependent on astronomy. Engineering has always kept in touch with mathematics; steam locomotion with physics; medicine, manufactures, and agriculture with advance in physiology and chemistry. But statesmanship and the art of government have remained where they were, from the time when Plato complained that it was generally felt that, although cooking and shoemaking required some special training, the government of men might safely be left to the first man who should happen to come along, and who—without previous experience—should have the gift, by means of words alone, of making the worse to appear the better reason. Now, if it were possible to get anything like a scientific chart of the actual progress of the

world, so as to ascertain to what extent a knowledge of economic science and the art of government could be of definite service to the politician and statesman, by marking out the track of the orbit of civilisation, society would be saved from as many quicksands as the mariner, to whom a chart is given by which to steer, instead of tacking about fortuitously at the mercy of wind and tide. It goes without saying, that without some such help the politician and statesman is almost sure to fall into illusions, and become a source of waste, or dangerous reaction to the state. Of this we have had ample proof in the many examples of caustic labour and industrial legislation which in recent years has been enacted by our Federal and State Parliaments. Unfortunately, society has often had to lament the effect of zealous yet unintelligent benevolence, it being as easy to injure as to benefit the working classes by measures which have their origin in the purest desires to promote their welfare ; thus, we find that philanthropy without knowledge is one of the most dangerous of errors. Social happiness, I venture to say, will never be produced by putting into sudden activity socialistic nostrums, nor the artificial contrivances of theorists who are bidding for Parliamentary distinction, but, by intellectual, moral, and religious culture, and by steadily working through long intervals the mechanisms of nature. It is the growth of ages, and not the efflorescence of Utopian fantasies, a growth whose roots are in the people's hearts. Benevolence and justice are essential to the right working of our social life, but these have been displaced by an almost exclusive selfishness, which creates an intense narrowness of sympathy. What is wanted is a universal sentiment of brotherhood, such a practical recognition of the essential equality of man's higher nature that shall batter down the cold conventionalities of society, and make the employing classes the friend of the working classes. The exhibition of such a spirit would remove many of the evils which now oppress society. Fire man with benevolence, and every species of wretchedness will excite his pity ; arm him with justice, and selfishness will soon be subdued. For this a divine remedy is needed, principles which can furnish motives from circumstances lying beyond the reach of human sight, and amidst the shallow yet turbid waters of this present life guide man's fragile barque by the pole-star of eternal truth.

ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

TWENTY-FIRST ANNIVERSARY CELEBRATION: HISTORICAL ADDRESS.*

By J. P. THOMSON, LL. D., Hon. F.R.S.G.S., etc.

THE glorious reign of Queen Victoria covered a period in human history remarkable alike for brilliant intellectual and industrial achievements as well as for the development of philosophical thought and the acquisition of geographical knowledge. It was this Victorian age that gave birth to the new school of Geography, its establishment on a permanent and universal basis, and its general recognition as one of the most essential, one of the most stimulating, one of the most informing, and one of the most comprehensive departments of scientific inquiry. Associated in the development and organisation of this modern geographical movement were some of the greatest intellectual workers of the nineteenth century, whose individual and united efforts were stimulated and advanced by the explorations and discoveries which have rendered the period one of the most fruitful and productive of recent times. In Europe Geographical Science had been long cultivated and studied and its academic position in the educational life of the Continent had risen to a high degree of importance and utilitarian significance. In France and in Prussia the professorial chairs of Geography at the great universities and other seats of learning attracted as their occupants some of the most accomplished scholars of the day, whose influence has been felt in all civilised parts of the globe. In the New World, too, there has been a general awakening extending throughout the whole length and breadth of the American Continent, where the geographical spirit has entered so largely into the scholastic life of the people. In Japan the same idea has taken root, at the Imperial University at Tokyo, and in Great Britain Oxford and Cambridge have at last recognised the importance of earth knowledge and the necessity of making provision for its study as a separate subject. In all civilised countries the light of earth knowledge has penetrated deeply and Geography has resumed its rightful place as the mother of the natural sciences and handmaid of many branches of science. And the development of geographic thought has given rise to great activity in the field

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of organised effort, where there is being acquired and disseminated information of the first importance concerning the earth and its place in Nature, as the abode of man. Concurrently with this revival there have sprung into existence a great number of organisations, whose energies are devoted exclusively to the interests of Geography in its widest sense. These include our own Society, whose Twenty-first Anniversary we are now assembled to celebrate, under such distinguished auspices as befit the occasion. The first Australian geographical efforts originated in Sydney and Melbourne, where societies were formed, independently of other local scientific bodies, and under the most favourable circumstances, which gave promise of the greatest success. In course of time the geographical needs of Queensland came to be considered and in the beginning of 1885 the organisation and subsequent formation of a local society became an accomplished fact, the initial steps being taken by the writer, on whom also devolved the duties of organiser and manager, in the absence of some one else better qualified for the arduous task. In this connection it may be of interest to mention that the idea of a Queensland society was of course first of all discussed with the veteran explorers, A. C. and F. T. Gregory, who, although not particularly sympathetic, were nevertheless invited to take the initiative, but for some unexplained reason declined to do so. In referring to this circumstance shortly before his death, the late Sir Augustus Gregory, on making complimentary allusion to the founder's work in connection with the Society, remarked that he knew of "no other man in Australia who could have accomplished so much with the same material," adding that he thought it was "only right and fair to say so." It will generally be conceded that no higher compliment could have been paid to the management of the Society, and such thoughtfully expressed, spontaneous, sentiments are merely mentioned now to show the generous nature of Gregory's character and his interest in the institution of which he himself had the first opportunity of being the founder.

The first idea was to establish the Queensland organisation as a branch of the "Geographical Society of Australasia," as the Sydney body originally suggested. But as the "Geographical Society of Australasia" had no actual or real existence at the time and was never afterwards properly constituted as such, the movement naturally assumed its present form of independence, and experience has amply justified the wisdom of such a course. But this was not so generally understood at the time as it ought to have been, for there were those who, during the earlier years of its activity, were indisposed to support the Society, believing it to be a branch of the Sydney organ-

isation and an allusion to " cutting the painter " was sometimes made in the public prints, the late Sir Thomas McIlwraith being one of the strongest opponents to any alliance with our Sydney colleagues. But there was really no need for any feeling of the kind, for the Society was free from outside control, having been established as a local institution and merely affiliated with the Australian movements in Sydney, Melbourne, and Adelaide, a circumstance to which the late Sir Charles Lilley alluded in his opening remarks, when presiding at the inaugural meeting held at the Town Hall, Brisbane. But this position of independence did not in any way prevent hearty co-operation with sister organisations in Australasia in any important movement affecting the interests of all. And there were several occasions when united action became mutually advantageous, such for example as when a joint Jubilee address was prepared by the Australasian Geographical Societies and presented to the late Queen, and other movements of general interest, showing that in matters of common concern co-operative effort was attended with results, the attainment of which would probably have been rendered more difficult single handed. But to feel that the only bond of union was one in no way depending upon constitutional enactment nor an arbitrary code of rules and regulations contributed in no small measure to the healthy stimulation of individual effort and the creation of friendly rivalry. And it would perhaps be equally advantageous to those concerned were all organisations and communities of people left to manage their own affairs on a similar independent basis, for it is easier and decidedly more agreeable to unite in harmony when occasion requires it than to separate in discord when once constitutionally bound together.

From the very first the Society set up for itself the cardinal principles of universal Geography, adopting a broad and comprehensive policy in the acquisition and dissemination of such knowledge as naturally falls within the scope of the department of geographical science, in its widest sense, and understood in the light of the present age. It was early recognised in the direction and management of the affairs of the Society that in a comparatively young country, whose remote territorial areas were even inadequately explored, whose resources were mostly undeveloped, whose local institutions were immature and whose intellectual life required the stimulating influence of example and precept, that there must be a liberal interpretation of the aims and objects of such an institution. It was felt that to keep abreast of the times, to establish a good reputation at home and abroad, to be of public utility and to serve the best interests of the State, the old school ideas of Geography must be discouraged and the obsolete system of instruction superseded by a

new and advanced line of teaching. And this would recognise as its principle a knowledge of the earth and its inhabitants, including man and his environment. The scope was comprehensive enough, embracing, as it does, a wide range of subjects, such for example as the study of geophysical phenomena, geomorphology, oceanography, cartography, ethnography, and ethnology; physical, mathematical, commercial, astronomical, and educational geography; the floras and the faunas, with such others as contribute to the numerous workable sub-divisions of the geographical department. And he who would depart from this principle by endeavouring to narrow down the subject must belong to an age that is past and be entirely out of date. In the inauguration and early pursuit of its work the Society encountered many obstacles and the impediments which lay in the path of the founder were both numerous and formidable. But this was chiefly because there were probably so few who really understood the work, and even now there are many who do not fully understand or fail to comprehend what Geography means, when considered in its broadest sense. This is no doubt in a measure due to circumscribed environment, for local scientific effort is mostly confined to specialised branches of inquiry or investigation, which in the very nature of things has an irresistable tendency to limit the horizon of associated workers and develop parochial ideas and sympathies. Anyway there has been a great deal of work accomplished, contrary to the predictions of those who were actually hostile to the movement, and as evidence of the success attained reference need only be made to the practical results of continuous and undiminished activity during the last twenty-one years, as well as to the position of equality which the Society occupies amongst the scientific and literary institutions of the world. These speak for themselves louder than any words can possibly do and are fully emphasised by the numerous commendatory messages that have been received from all parts of the globe on the occasion of this celebration. And we may be pardoned for remarking that it is extremely doubtful if in the whole history of organised intellectual effort there is another institution in Australia whose active life has been so vigorous and fully sustained from the beginning. In point of fact we cannot recall a similar instance of uninterrupted activity. But in the main although the Society's operations have covered a fairly wide scope there was always the desire to give preferential consideration to subjects of local interest, although the aims of such a body are essentially universal in character and not merely parochial as its title implies In the earlier days it was not always an easy matter to procure suitable papers for the monthly meeting, and much care and judgment were necessary in the r selection, because of the limited

source of supply and the tendency of authors towards a too great restriction in the treatment of subjects. Still no meeting ever fell through for the want of a paper and there have only been two occasions (both recent) on which an adjournment of the regular monthly meetings of the Society became necessary—one in consequence of a prevailing epidemic and the other on account of the death of the first President. As giving an idea of the comprehensive nature of the Society's operations and the range of subjects treated it may be noted that of the total number of papers read, printed and published 25% relate to Queensland, over 41% refer to Australasia, including Tasmania, New Zealand, New Guinea, and the Pacific Islands; 27% deal with general geographical subjects and the balance are distributed over Europe, Asia, America, and the South Polar regions. And it is satisfactory to find that of all the communications which appear in the twenty one volumes of the "Proceedings and Transactions," about 80% are original contributions to geographical literature, the remainder being the result of research work, in contra distinction to mere compilations. From this brief analysis it will be seen that the work accomplished has been practical and substantial. And although some of the earlier efforts of contributors may lack that elegance of style and other good qualities of literary composition, acquired by long experience, it must be remembered that in all human enterprises there is a pioneering period and that the most valuable treasures are usually at first found in the rough state. Any way, our papers have stood the test of time, their fidelity never having once been questioned, although they have been widely circulated over the world, and often freely quoted. In point of fact the demand, yearly increasing, for back numbers of our publications is greater than the supply and for some years now it has been found impossible to send the earlier volumes to kindred institutions and other public bodies who have made application for them. It cannot be doubted that this kind of tangible evidence is the most satisfactory testimony as to merit and wide appreciation of local work. There has been no interruption in issuing the publications of the Society, which have been sent out regularly from the beginning. And besides the edition issued to the members, about three hundred copies are mailed free to public libraries, government departments and kindred institutions all the world over. In exchange for these the Society receives a corresponding number of valuable publications with which the ibrary is enriched. And there is little doubt that this library is the most cemprehensive and complete of its kind in the State, contain ing as it does thousands of valuable works, representing every department of science, letters, and arts in all the languages, besides a great

variety of maps and atlases. It is, in point of fact, a storehouse of the choicest literature issued from the intellectual press of the world, giving expression to the scientific and learned thought of the age and recording with singular fidelity the entire progress of human knowledge. It is, however, regrettable that this magnificent and locally unique repository is not more widely and generally utilised by the members, to whom it belongs, or by others who would wish to obtain the privilege. Not alone for purposes of reference is this storehouse available, but it is stocked with entertaining and informing personal narratives of travel, fascinating descriptions of such natural phenomena as have occurred over the entire surface of the globe or even extending to the celestial sphere, and the instructive results of investigations which have been conducted from time to time into the terrestrial floras and faunas, including the life history of the human race and man's place in the economy of nature. And yet what a glorious paradise this geographical library would be to the rising generation of boys and girls who are preparing and qualifying themselves for the strenuous duties that lie before them, and upon whom, moreover, will devolve the duty of perpetuating the race. But the modern boys and girls are not too keen on consulting the library of a scientific and literary society, no matter how instructive or how entertaining the contents may be. The environment is not deemed to be sufficiently attractive when the fiction-stocked public reading rooms are so easily accessible and available to all. What a pity the position is not more seriously considered in youth, and it is unfortunate that the every day problems and realities of life are not realised more fully and studied more generally. But the subject of such study is not popular, as the tendency of the age leans more towards the artificial and superficial phases of domestic economy, in which original thought finds no place and serious considerations are not encouraged. But in continuation of my subject, it may be remarked that as at present constituted the Geographical Society is a thoroughly representative and up-to-date institution, in which encouragement is afforded to all active workers. As a means of communication with the intellectual world at large, it offers greater facilities than any other existing local organisation, its aims being sufficiently comprehensive to cover a very wide and almost unlimited range of inquiry. And in this connection it recognises that while specialised branches of science are necessary to progress, such specialisation can only be regarded " as a phase of a working life and not as the whole purpose of a whole man." As the only local body devoted exclusively to the interests of Geography, in its widest sense, the Society recognises no class distinctions, no political shades and no religious or ethical

lines of thought. As an exponent of earth knowledge, with lofty aims and noble purpose, the society in its capacity as one of the representatives of the oldest of all the sciences, is a stranger to such subjects and discussions of a controversial or political tendency as are calculated to induce dissension and division among men. And in contradistinction to such subjects it recognises and encourages the confraternity which should exist among students of human knowledge of all nationalities, irrespective of other considerations. Viewed from this standpoint alone the objects of the Geographical Society are such as to command the respect and practical sympathies of all intelligent classes of the community, to whom the society, in opening its doors and extending a hearty welcome, also affords one of the best channels of communication with the intellectual world at large. Judged on its merits alone it has put up a record of good, substantial, honest, practical work, in which the best interests of science and the State of Queensland have been equally served, with fidelity and patriotism. As the results of the first decade of the society's operations have already been summarised in the interesting historical review published in the eleventh volume of our "Proceedings and Transactions," this address is necessarily more general in character than would otherwise have been the case. But many changes have occurred during the last ten years, which have left their mark behind them, and to which some slight allusion may naturally be expected from me. It is not, however, my present intention to go into the subject in great detail, but rather to touch in a general way upon things that have happened. Amongst such happenings nothing has perhaps been felt more keenly than the removals from our ranks occasioned by death or misfortune. It tinges one's feelings with a painful sadness to look back on the early days that gave birth to the institution whose anniversary it is now our privilege to celebrate and to find that out of those pioneers actually present at the preliminary and inaugural meetings, the writer is the only one whose name is left on the roll of members. Gregory, my intimate friend and fellow worker, who was our first President, and Sir Charles Lilley, chairman at the inauguration, have passed away, and so has W. Alcock Tully, who presided over the first meeting of all. And Sir Anthony Musgrave, our first Patron, he too has long ago gone over to the great majority. We then pass on to more advanced years, when Sir Henry Norman's influence made itself so largely felt on our active life, contributing in no small measure to the popularisation of our monthly meetings and materially assisting in the administrative and executive work of the society, by personal participation and example. It is, in point of fact, difficult to estimate the extent and

value of Sir Henry Norman's loyal support and assistance rendered to the Secretarial office, not only while Governor of Queensland, but even after leaving the State and up to the time of his widely lamented death his interest in the work of the society was keen, practical and loyal. Another popular President and greatly esteemed pioneer colonist, who has gone the way of all flesh, was the Honourable William Allan, a staunch and worthy colleague, for whom I entertained affectionate feelings of friendship. And coming to more recent events we still mourn the loss of Sir Hugh Nelson, whose genial and kindly presence at all meetings of the society will long be remembered by members and friends alike, to whom his zeal and intelligent enthusiasm were a source of admiration and pleasure. Sir Hugh was an ideal President in every respect and it would indeed be difficult to find a man in any sphere of life who so readily assumed the duties of his Presidential office and so enthusiastically devoted himself to the study of geographical science, to which, as he himself frequently acknowledged, he had formerly been an entire stranger. And we are gratified to find that in concluding an appreciative and sympathetically written notice of the death of our late President the April number of the London Society's "Geographical Journal" says: "His interest in Geography is sufficiently indicated by his position at the head of the Queensland Society; in particular he did a useful work in extending the activity of the society in other parts of the State outside of Brisbane." It is, however, an extremely fortunate thing that we have been able to secure so worthy a successor to the late occupant of the Presidential chair as the present distinguished head of the society, Lord Chelmsford, under whose guidance our useful work will be continued in the best interests of the State, at the same time contributing to the storehouse of human knowledge, with some measure of credit to ourselves. And let me now remark that it is a matter of the utmost gratification and pleasure to the Society and, I am sure, to the citizens of Queensland at large, to have His Excellency here amongst us again in good health. We earnestly hope that he may long continue to enjoy that inestimable blessing.

Of the living members who have formerly taken an intelligent and enlightened part in our proceedings it is pleasant to gratefully refer to our old friends Lord Lamington and Sir Herbert Chermside, whose active participation in our local work was for several years a popular feature of our monthly gatherings, and whose support and encouragement to the Secretarial office rendered successful direction and management possible under favourable auspices. And in this connection it must not be overlooked that we are indebted to our

present Vice-President for the inauguration of the series of successful provincial meetings which constituted so important a part of our sessional programme some two or three years ago, the movement having originated in a suggestion to the Council by Mr. Morgan, to whom the great success of the first meeting at Warwick was so largely due. At the time it was largely recognised that those meetings, held at Warwick, Toowoomba, and Maryborough, were in the best interests of the State and it is to be hoped that the greatly improving conditions of the country at large will favour their continuance and extension to other provincial towns before long. Amongst other co-operators who have identified themselves with our Geographical activities, it is at once a pleasure and a duty to briefly refer to the services rendered by those members of the Council who have for so many years cheerfully devoted time and attention to the business of the society, and to whom the best thanks of our associates are so largely due. As at present constituted, it may fairly be said that we have one of the most active and representative Councils that could be got together anywhere.

In alluding to our cordial relations with kindred institutions it is extremely gratifying on the occasion of our twenty-first anniversary celebration to be able to communicate to our members the outline of an important scheme recommended by the Eighth International Geographical Congress, held in the United States of America, last year, for the purpose of bringing about an affiliation of the Geographical Societies of the world. "The object of the plan is to make it possible for a member of any Geographical Society, who may be travelling, or temporarily present at the seat of some other Geographical Society, to be welcomed as a guest by the Society he may wish to visit. Such privileges will be granted as the use of the Library or map room of the Society, attendance upon lectures or meetings, or presence on the same footing as an ordinary member at such social functions as may be organised by the Society. In order to secure a means of identification the card of membership for the current year of any of the affiliated Societies, shall serve as an introduction for the holder, to any of the other Societies—provided that these cards are signed by the Secretary of the Society issuing them and that the cards shall not be transferable. Upon the presentation of such a card, with a statement of the length of time the member proposes to be present the Secretary of the visited Society shall place the name of the visitor upon a list which shall secure his reception of such notifications of meetings, etc., as may be deemed advisable." The great advantages of such a universal arrangement are so evident that they cannot fail to be appreciated by all members

and friends of the Geographical organisations of the entire world. And it is a matter for the heartiest congratulation to all of us that our Society is in a position to co-operate and to participate in such a far reaching movement, calculated to promote international intercourse on terms of equality and to have an important bearing on the future development of our geographical activities and thoughts.

An address of this nature could hardly be concluded without some slight allusion to the general management and direction of the affairs of the Society, although it is extremely difficult to speak on a subject which in the very nature of things is more or less personal. Still the remarks that follow are merely statements of fact, no matter by whom they may be made, and must be accepted as purely historical, apart from personal considerations altogether. It must first of all be laid down as a fundamental principle for the successful administration and management of all organisations of the kind, that the affairs of a scientific and literary society, differing so widely as they do from social clubs or other similarly constituted local bodies, must be conducted on approved scientific lines. Accepting this as a *sine qua non* to success it becomes of the utmost importance to have a suitable officer possessing the necessary scientific and administrative qualifications to carry out the work. And this is recognised to be an essential factor in the management of all kindred societies the world over. But it is equally important that in addition to such qualifications there should be combined enthusiasm and adaptability or natural love for the work. In other words a man must be moulded by nature for the duties of such an office to carry them out to a successful issue. Long and varied experience has however clearly shown that this ideal is difficult of realisation and that such a man is as hard to find as the proverbial four leaf shamrock. Men are ready enough to take up work of the kind for a while, but there is usually the entire absence of sustained effort and enthusiasm, and as soon as the novelty wears off the duties are either entirely neglected or performed in a perfunctory manner. And this is one of the chief reasons why the life history of so many societies has been cut short. As a matter of fact experience has made it abundantly clear in every country of the world that without an efficient executive officer as Secretary to manage the scientific and business affairs of a Society the President and Council, no matter how eminent, will be unable to make much headway and must in course of time become an inactive body possessing no initiative power of action. This is so generally recognised that none but highly qualified men of known ability and eminence are selected for such positions, in which they become experts and leaders of thought.

The special work of the Queensland Geographical Society is the product of a life's study on the part of the Founder and the present success of the Society has only been rendered possible by personal self sacrifice and unswerving devotion to the lofty ideals of duty. There is no Royal Road to Success in any department of knowledge, and he who would gain laurels in the field of geographical activity must dedicate his life to the best interests of the cause, and be prepared to toil when the world slumbers. In most human affairs it is no doubt easy to be wise after the event, but looking back on the events of the last twenty-one years it may be conscientiously and honestly said that there has been nothing in the secretarial work of the Society which would be done differently had the same to be gone over again in the light of present experience. And this is a great deal to say for the system of administration adopted. But the present position has only been reached after long years of continuous, laborious effort, in which the objects of the Society and the best interests of the State at large were always first considered. It is felt that it would be futile to attempt, even if possible, to adequately describe the arduous and exacting labour involved during this pioneering period under review. For it is doubtful if the extent of personal material loss and self-denial on the part of the Founder will ever be realised or fully known to any one, not even to himself. From the very first the work has been done without any remuneration whatever, and as it is quite certain that no form of payment could have adequately compensated the officer upon whom has devolved the Secretarial duties it were decidedly better that the position should be honorary and that such duties should have been all along performed in the manner indicated. And there are really very few, if any, uninitiated people who realise what these duties mean in a scientific society publishing a "Journal" of proceedings and transactions. The preparation of this "Journal" for press, the revision of proofs, the arrangements necessary for monthly meetings, the procuration of suitable papers and addresses for these meetings, and the conduct and management of all the routine business of the Society, naturally fall upon the Hon. Secretary's shoulders, as well as the usual mechanical drudgery inseparable from the establishment and building up of such an institution, in a country like Queensland. But while refraining from making any further allusion to matters which may be deemed more or less of a personal nature, common fairness and justice to our members prompt me to specially emphasise the public utility of our work and to point out that during all these years of useful endeavour the Society has been advertising and advancing the best interests of the State, free of cost. As a matter of fact the Society has for a long time been acting as an inquiry bureau

or channel of communication with all parts of the globe, supplying information concerning Queensland to companies, public bodies and individuals, and for years the resources of the society have been taxed to the utmost to meet the foreign demands for our publications that have come before the Council from time to time. And, to use a newspaper quotation, " All this has been done without costing the country a cent."

But all the same we take the utmost pleasure in advancing the interest of the State and will continue to do our best for the good of the country and the progress of Geographical Science, realising that in the diffusion of useful information amongst men we will contribute to knowledge and justify our existence as a public body. And in doing this we have a claim on the sympathy and support of all intelligent citizens, to whom we extend a cordial welcome to our ranks. Let it be considered an honour and the duty of every patriotic citizen of the State to claim Membership of the Society and a reproach for anyone to show ignorance of that great department of knowledge in whose interests we labour. The Science of Geography is the most fascinating and useful of all the subjects which serve as food for the human mind, and its important bearing on the economic and industrial activities of life, renders its study essential in every enterprise, at home and abroad, as qualifying for the more efficient discharge of man's duties and obligations, and rendering him a more effective element in the economy of nature. In conclusion it only remains for me to thank all loyal colleagues who have rendered service to our cause and have helped to build up the Society to its present position of usefulness, as one of the most successful institutions in Australasia. To the local Press the Society's best thanks are also due for sympathetic support and an enlightened interpretation of its aims and objects.

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THE PRESENT PROBLEMS OF GEOGRAPHY.*

By HUGH ROBERT MILL, LLD., D.Sc.

THE present problems of a science may, I hope, be viewed as those problems the solution of which at the present time is most urgent and appears most promising. Were present problems held to include the whole penumbra of our ignorance, I at least have neither the desire nor the competence to discourse upon them. So much has been written on the problems of geography in recent years that a detailed summary of the existing literature would be a ponderous work, and afford much dull and contradictory reading. I cannot even attempt to associate different views of the problems of geography with the names of their leading exponents, though, perhaps, if I were to do so, I should quote with almost entire approval the masterly address recently delivered to the American Association for the Advancement of Science by Prof. W. M. Davis.

Believing that every geographer should approach such a question as this by the avenue of his own experience, I offer a frankly personal opinion, the outcome of such study, research, and intercourse with kindred workers as have been possible to me during the last twenty years. The views I hold may not be representative of European, perhaps not even of British, geographical opinion, except in so far as they are the result of assimiliating, more or less consciously, the writings and teachings of geographical leaders in all countries, retaining congenial factors, and modifying or rejecting those which were foreign to the workings of my own partially instructed mind.

The history of every branch of science teaches that time works changes in the nature and the value of the problems of the hour. In successive ages the waves of existing knowledge made inroads upon the shores of ignorance at different points. For one generation they seem to have been setting, with all their force, against some one selected point ; in the next they are encroaching elsewhere, the former problem left, it may be, imperfectly solved ; but gradually the area of the unknown is being reduced on every side, however irregularly.

In the beginning of geography, the problem before all others was the figure of the Earth. Scientific progress, not in geography alone, but in all science, depended on the discovery of the truth as to form. No sooner was the sphericity of the Earth established than two fresh problems sprang to the front, neither of them new, for both existed from the first—the fixing of position, and the measurement of the size of the

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* Read at the Anniversary Celebration of the Royal Geographical Society of Australasia, Queensland, June 27, 1906.

Earth. Geography, and science as a whole, progressed by the failures, as well as by the successes, of the pioneers who struggled for centuries with these problems. Latitude was a simple matter, theoretically no problem at all, but a direct deduction from the Earth's form, though its determination was practically delayed by difficulties of a mechanical kind. The problem of the longitude was far more serious, and bulks largely in the history of science. Pending their solution, the estimates of size were rough guesses ; had they been more accurate, it is doubtful if Columbus could have persuaded any sane sailor to accompany him on his westward voyage to India, the coast of which he was not surprised to find so near to Spain as the Caribbean Sea.

After latitude could be fixed to a nicety, and longitude worked out in certain circumstances with nearly equal accuracy, the size of the Earth was determined within a small limit of error, and the problem of geography shifted to detailed discovery. This phase lasted so long that even now it hardly excites surprise to see an article, or to open a volume, on the history of geography, which turns out to be a narrative of the progress of discovery. Perhaps British geographers, more than others, were prone to this error, and for a time the country foremost in modern discovery ran some risk of falling to the rear in real geography.

It is not so paradoxical as it seems to say that the chief problem of geography at present is the definition of geography. Some learned men have said within living memory, and many have thought, that geography is not a science at all, that it is without unity, without a central theory, that it is a mere agglomerate of scraps of miscellaneous information regarding matters which are dealt with scientifically by astronomers, geologists, botanists, anthropologists, and others. Geography is not so circumstanced. Although its true position has only recently been recovered from oblivion, it is a science, and one of long standing.

I have said before,* and I may repeat, because I can say it no better, that modern geography has developed by a recognizable continuity of change from century to century. I am inclined to give more weight than others have done to the remarkable treatise of Dr. Nathanael Carpenter, of Exeter College, Oxford, published in 1625, as a s age in the growth of geographical thought and theory. The striking feature of Carpenter's book is the practical assertion of the claims of common sense in dealing with questions which superstition and tradition had previously influenced. Varenius, who died at the age of twenty-eight, published in 1650 a single small volume, which is a model of conciseness of expression and logical arrangement well worthy even now of literal translation into English. From several points in its arrangement, I am inclined to believe that he was influenced by

* British Assoc. Reports—Presidential Address in Section E. Glasgow, 1901.

Carpenter's work. So highly was Varenius's book thought of at the time that Sir Isaac Newton brought out an annotated Latin edition at Cambridge in 1672. The opening definition as rendered in the English translation of 1733 a work largely spoilt by stupid notes and interpolations runs—

"Geography is that part of *mixed mathematics* which explains the state of the Earth and of its parts, depending on quantity, viz., its figure, place, magnitude, and motion with the celestial appearances, etc. By some it is taken in too limited a sense, for a bare description of the several countries; and by others too extensively, who along with such a description would have their political constitution."

Varenius produced a framework of Physical Geography capable of including new facts of discovery as they arose; and it is no wonder that his work, although but a part, ruled unchallenged as the standard text-book of pure geography for more than a century. He laid stress on the causes and effects of phenomena as well as the mere fact of their occurrence, and he clearly recognised the influence upon different distributions of the vertical relief of the land. He did not treat of human relations in geography, but, under protest, gave a scheme for discussing them as a concession to popular demands.

As Isaac Newton, the mathematician, had turned his attention to geography at Cambridge in the earlier part of the eighteenth century, so Immanuel Kant, the philosopher, lectured on the same subject at Konigsberg in the later part. The science of geography he considered to be fundamentally physical, but physical geography formed the introduction and key to all other possible geographies, of which he enumerated five: *mathematical*, concerned with the form, size, and movements of the Earth and its place in the solar system; *moral*, taking account of the customs and characters of mankind according to their physical surroundings; *political*, concerning the divisions of the land into the territories of organized governments; *mercantile*, or, as we now call it, commercial geography; and *theological*, which took account of the distribution of religions. It is not so much the cleavage of geography into five branches, all springing from physical geography like the fingers from a hand, which is worthy of remark, but rather the recognition of the interaction of the conditions of physical geography with all other geographical conditions. The scheme of geography thus acquired unity and flexibility such as it had not previously attained, but Kant's views have never received wide recognition. If his geographical lectures have been translated, no English or French edition has come under my notice; and such currency as they obtained in Germany was checked by the more concrete and brilliant work of Humboldt, and the teleological system elaborated in overwhelming detail by Ritter.

Ritter's views were substantially those of Paley. The world, he found, fitted its inhabitants so well that it was obviously made for them down to the minutest detail. The theory was one peculiarly acceptable in the early decades of the nineteenth century, and it had the immensely important result of leading men to view the Earth as a great unit with all its parts co-ordinated to one end. It gave a philosophical, we may even say a theological, character to the study of geography.

Kant had also pointed to unity, but from another side, that of evolution. It was not until after Charles Darwin had fully restored the doctrine of evolution to modern thought, that it was forced upon thinking men that the fitness of the Earth to its inhabitants might result, not from its being made for them, but from their having been shaped by it. The influence of terrestrial environment upon the life of a people may have been exaggerated by some writers—by Buckle, in his 'History of Civilization,' for example—but it is certain that this influence is a potent one. The relation between the forms of the solid crust of the Earth and all the other phenomena of the surface constitutes the very essence of geography.

It is a fact that many branches of the study of the Earth's surface which were included in the Cosmography of the sixteenth century, the Physiography of Linnæus, the Physical Geography of Humboldts and perhaps even the *Erdkunde* of Ritter, have been elaborated by specialists into studies which, for their full comprehension, require the whole attention of the student; but it does not follow that these specializations fully occupy the place of geography, for that place is to co-ordinate and correlate all the special facts concerned so that they may throw light on the plan and the processes of the Earth and its inhabitants. This was clear to Carpenter in 1625, though it has been almost forgotten since.

The principles of geography on which its claims to status as a science rest are generally agreed upon by modern geographers, though with such variations as arise from differences of standpoint and of mental process. The evolutionary idea is unifying geography as it has unified biology, and the whole complicated subject may be presented as the result of continuous progressive change brought about and guided by the influence of external conditions. It is impossible to discuss the present problems of geography without once more recapitulating the permanent principles.

The science of geography is, of course, based on the mathematical properties of a rotating sphere; but there is force in Kant's classification, which subordinated mathematical to physical geography. The vertical relief of the Earth's crust shows us the grand and fundamental

contrast between the oceanic hollow and the continental ridges ; and the hydrosphere is so guided by gravitation as to fill the hollow and rise upon the slopes of the ridges to a height depending on its volume, thus introducing the great superficial separation into land and sea. The movements of the water of the ocean are guided in every particular by the relief of the sea-bed and the configuration of the coast-lines. Even the distribution of the atmosphere over the Earth's surface is affected by the relief of the crust, the direction and force of the winds being largely dominated by the form of the land over which they blow. The different physical constitution of land, water, and air, especially the great difference between the specific heat and conductivity or diathermancy of the three, causes changes in the distribution of the sun's heat, and as a result the simple climatic zones and rhythmic seasons of the mathematical sphere are distorted out of all their primitive simplicity. The whole irregular distribution of rainfall and aridity, of permanent, seasonal, and variable winds, of sea climate and land climate is the resultant of the guiding action of land forms on the air and water currents, disturbed in this way from their primitive theoretical circulation. So far we see the surface forms of the Earth, themselves largely the result of the action of climatic forces, and constantly undergoing change in a definite direction, controlling the two great systems of fluid circulation. These in turn control the distribution of plants and animals, in conjunction with the direct action of surface relief, the natural regions and belts of climate dictating the distribution of living creatures. A more complicated state of things is found when the combined physical and biological environment is studied in its incidence on the distribution of the human race, the areas of human settlement, and the lines of human communications. The complication arises partly from the fact that each of the successiv earlier environments acts both independently and concurrently ; but the difficulty is in greater degree due to the circumstance that man alone among animals is capable of reacting on his environment and deliberately modifying the conditions which control him.

I have said before, and I repeat now, that the glory of geography as a science, the fascination of geography as a study, and the value of geography in practical affairs, arise from the recognition of this unifying influence of surface relief in controlling, though in the higher developments rather by suggestion than dictation, the incidence of every mobile distribution on the Earth's surface. I am inclined, in the light of these views, to put forward a definition of geography which I think may be accepted in principle, if not in phrase, by most of the class called by Prof. Davis " mature geographers."

It runs, *Geography is the science which deals with the forms of relief o'*

the Earth's crust, and with the influence which these forms exercise on the distribution of all other phenomena.

The old pigeon-hole view of human knowledge is now happily discredited and recognised as useless, save perhaps by some Rip van Winkles of science, who concern themselves more with names than things, and would placidly misconceive the facts of nature to fit the framework of their accepted theories. High specialization is necessary to progress but only as a phase of a working life, not as the whole purpose of a whole man.

It is convenient and often profitable for a man of science to have a recognized label, but it seems to me that important advances are to be made by cultivating those corners of the field of knowledge which lie between the patches where the labelled specialists toil in recognised and respected supremacy. It has been so habitual to classify the man of science by what he works in, that it almost requires an effort to see that the way in which he works is of greater determinative importance. Thus the scientific geographer is apt to find no place in the stereotyped classification, and his work may be lost sight of on that account. Should he dwell on latitude and longitude, the astronomer smiles pityingly ; if he looks at rocks, the geologist claims that department ; if he turns to plants, the botanist, with the ecologist behind him, is ready to warn him off ; and so with other specialists. But the mature geographer seeks none of the territory, and hankers after none of the goldfields belonging to other recognized investigators. He works with the material they have already elaborated, and carries the process a step further, like the goldsmith handling the finished products of the metallurgist and the miner.

The present problems of geography seem to me to be of two kinds the first minor and preliminary, the completion of the unsolved and partially solved problems of the past ; the second ultimate and essential dealing with the great problem on the solution of which the whole future of the science rests.

The residual problems inherited from the past represent the work which should have been done by our predecessors, but, not having been done at the right time, remains now to bar our progress. It has to do only with ascertaining and accurately recording facts, and involves infinite labour, but comparatively little geographical thought.

To begin with, the ground should be cleared by wiping off the globe the words *terra incognita*. Such unknown parts of the Earth now clin about the poles alone, and that they should even do this is something of a disgrace. If common terrestrial globes were pivoted on equatorial points, so that the polar areas were not covered with brass mountings, the sight of the bare patches would perhaps have been so galling to the

pride of humanity that they would long since have been filled in in detail. Again and again, and never more splendidly than in recent years, polar explorers have shown courage and perseverance, and have cheerfully encountered hardships enough to have enabled them to reach the poles, and they would have done so not once, but many t mes, were it not for the want of money. Of course, all polar explorers have not been competent for the task they undertook, but most of the leaders, if they had had more powerful ships, more coal, more stores, more dogs—and sometimes if they had had fewer men—could have solved these perennial problems of exploration. With a competent man in command—and competent men abound—a sufficiency of money is all that is required. A million dollars judiciously spent would open the way to the north pole, a few millions would reach the south pole ; but far more than this has been spent in vain because the money was doled out in small sums at long intervals, sometimes to explorers with no real call to the quest, and working in accordance with no scientific plan.

The grand journeys over the polar ice of Nansen, Peary, and Cagni in the north, and of Scott and his company in the south, promise well for an early solution of this particular problem.

The other residual problems of exploration and survey are in the same case. If those who control money saw it to be their duty to solve them, they would all be solved, not in a year, but in due time. Though a great deal of exploration remains to do, the day of the ignorant explorer is done. The person who penetrates a little-known country in search of adventures or sport, or in order to go where no one of his colour or creed had been before, is, from the geographical point of view, a useless wanderer ; and if he be a harmless wanderer, the true explorer who may follow in his footsteps is uncommonly fortunate. Exploration now requires, not the pioneer, but the surveyor and the student.

The map of the world ought to be completed, and it is the duty and, I believe, the interest of every country to complete at least that portion which includes its own territory. An imperial policy which ignores such an imperial responsibility is a thing of words, and not of deeds. Unsurveyed and unmapped territory is a danger, as well as a disgrace, to the country possessing it, and it would hardly be too much to say that boundary disputes would be unknown if new lands were mapped before their mineral wealth is discovered. The degree of detail required in any survey depends upon the importance of the region. The desideratum is not a large-scale map of every uninhabited island, but a map of the whole Earth's surface on the same scale, which for the present may be a small one, and might very well be that of 1 : 1,000,000 proposed by

Prof. Penck, and now being carried into effect for the surveyed portions of the land. Such a map ought to include sub-aqueous as well as sub-aerial features, and when completed it would form a solid basis for the full discussion of many problems which at present can only be touched upon in a detached and unsatisfactory manner. The first problem which it would solve is the measurement of the volume of the oceanic waters and of the emergent land, so that the mean depth of the oceans and the mean heights of the continents might be exactly determined. This would involve, besides the horizontal surveys, a vertical survey of considerable accuracy. At sea the vertical element is easily found, and the depths measured by surveying and exploring vessels in recent years are very accurate. They must, however, be made much more numerous. On land, outside the trigonometrically surveyed and spirit-levelled countries, the vertical features are still most unsatisfactorily delineated. Barometric determinations, even when made with mercurial barometers or boiling-point thermometers, are uncertain at the best, while when made with aneroids they afford only the roughest approximations to the truth. Where levelling is impracticable, angular measurements of prominent heights, at least, should be insisted on as an absolute necessity in every survey.

When a map of the whole surface of the Earth on the scale of 1 : 1,000,000 is completed, we may consider the residual problems as solved. This is far from being the case as yet, and in the present circumstances the most useful work that the geographical societies of the world could do would be to secure the completion of explorational surveys to that scale. The system of instruction for travellers established by the Royal Geographical Society has equipped a large number of explorers and colonial officials as expert surveyors, and the result is now being felt in every quarter of the globe. This is not the highest geographical work, but merely preliminary and preparatory; yet progress is checked, if not barred, until it is accomplished. The map of one to a million is not to be viewed as an end in itself; nevertheless, its completion will mark an era, the accomplishment of the small-scale survey of the globe, and permit of fresh advances.

Money could solve the last of the problems of exploration, but when we come to problems of the second category we enter a region of pure science, where money becomes a minor consideration. The acquisition of knowledge is a simple process, for which multitudes have a natural aptitude; but the co-ordination of knowledge and its advancement are very different matters. The difference is more marked in the case of geography than in geology or chemistry or physics, for, in English-speaking countries at least, the training of geographers is in its infancy, whilst that of the exponents of other sciences is highly developed.

Hence it happens that before any actual problem in geography can be attacked, the man who is to deal with it must be prepared on purpose for the task, and he must have determination enough to stick to an unpopular subject with little encouragement in the present and small prospects for the future. Such men are not very easily found.

If they can be found, the problems they should be set to solve are at hand and waiting. We know enough about the relations of mobile distributions to fixed environments to feel satisfied that the relations are real and of importance; but we do not yet know enough to determine exactly what the relations are and the degree in which they apply to particular cases. It is the province of geography to find this out, and to reduce to a quantitative form the rather vague qualitative suggestions that have been put forward. The problem is multiform and manifold, applying to a vast range of phenomena, and those who have surveyed it are often inclined to sigh for a Kepler or a Newton to arise and call order from the chaos.

A vast amount of material lies before the geographer with which to work, even though, as has been explained, much more is needed before the data can be looked upon as complete. After seeing that the missing facts are in course of being supplied, the great thing is to work and to direct the work of others towards the proper comprehension of the facts and their bearings. This involves as much the checking and discouragement of work in wrong or useless directions as the help and encouragement of well-directed efforts.

The first element of geography is the configuration of the crust of the Earth, and our knowledge is already ripe for a systematic classification of the forms of the crust, and for a definite terminology by which to describe them. For some reason, not easy to discover, geographical terms, with the exception of those handed down from antiquity, have not, as a rule, been taken from the Greek like other scientific terms. They have usually been formulated in the language of the author who has introduced them. For this reason they retain a national colour, and, absurd as it may seem to scientific reflection, national or linguistic feeling is sometimes a bar to their general adoption. A more serious difficulty is that different languages favour different modes of thought, and thus lead to different methods of classification. The clearness and definiteness of French conduces to the use of simple names, and the recognition of definite features distinguished by clear differences. The facility for constructing compound words presented by German, lends itself to the recognition of composite types and transition forms, the introduction of which often swells a classification to an almost unmanageable complexity. English stands intermediate between those anguages, less precise perhaps than French, certainly less adaptable

than German, and English terminologies often reflect this character. The best way out of the difficulty seems to be to endeavour to arrive at a general understanding as to a few broad types of land form which are recognized by every one as separate and fundamental, and then to settle equivalent terms in each important language by an international committee, the finding of which would have to be ratified by the national geographical societies. These terms need not necessarily be identical, nor even translated literally from one language into another, but their equivalence as descriptive of the same form should be absolute. A recent international committee appointed for the nomenclature of the forms of sub-oceanic relief put forward certain suggestions in this direction which might well be adapted to the forms of sub-aeriel relief as well. But there are strong-willed geographers who will recognize no authority as binding, and who will not, I fear, ever conform to any scheme which might threaten their liberty to call things as they please

Personally, I would go very far to obtain uniformity and agreement on essential points, but the only way to do so seems to be to arrive by general consent at a classification that is as brief, simple, and essential as possible.

It is necessary to classify land-forms according to their resemblances and differences, so that similar forms may be readily described wherever they may be. The fixed forms of the crust are the foundation of all geography, the ultima e condition underlying every distribution, the guiding or controlling resistance in every strictly geographical change. The question of place-names is altogether subordinate. It is convenient that every place should have a name, and desirable that the name should be philologically good, but the national boa ds of geographic names, geographical societies, and survey departments see to that, and do their work well. The question of terminology is far more difficult and, I think, more pressing.

The g and problem of geography I take to be the demonstration and quantitative proof of the control exercised by the forms of the Earth's crust upon the distribution of everything upon the surface or in contact with it which is free to move or to be moved. It is a great problem the full solution of which must be long delayed, but every part of it is abud with minor problems of detail, alike in nature, but differing widely in degree. These minor problems claim our attention first, and are so numerous that one fears to attempt their enumeration because of the risk of distracting attention from the main issue. Geography was defined long ago as the science of distribution; but the old idea was statical distribution, the laying down on maps of where things are; now we see that we ought to go further, and discuss also how the things came there, why they remain there, whether they are in transit, and, if

so, how their path is determined. We are learning to look on distribution from its dynamical side, the Earth with all its activities being viewed as a machine at work. The geographer, as an independent investigator, has to deal only with matters touching or affected by the crust of the Earth ; his subject is limited to a part only of the economy of the Kosmos, a fact that sometimes seems to be in danger of being forgotten.

The quantitative relationships of crustal control have to be worked out for different areas with different degrees of detail. A great deal has been done already, and the material for much more has been collected in a form fit for use. The first step in commencing such a discussion is the accurate mapping of all available data—each kind by itself—for the particular area. On the national and almost continental scale, this is done better in the United States Census Reports than in any other works known to me. An adequate discussion of all that is shown in the maps accompanying these Reports, and in those of the Coast and Geodetic Survey, the Geological Surveys, and the Department of Agriculture, would be almost an ideal geographical description. The material provided in such rich profusion by the Federal and State governments is being used in American universities with an originality and thoroughness that has developed the conception of geography and advanced its scientific position. American geographers more than others have grasped the dynamic idea of geography, and realized that the central problem is the elucidation of the control or guidance exercised by fixed forms on mobile distributions.

Detailed work in the same direction has been done by many European geographers whose works are too well known to require citation ; but the geographical treatment of statistics has not been taken up adequately by public departments in the countries east of the Atlantic. I will touch only on the instance most familiar to me. Except the publications of the Admiralty, Ordnance and Geological Surveys, which cannot be surpassed, the maps issued by British Government Departments in illustration of their reports are rarely more than diagrams delimiting the areas dealt with, but not depicting the distributions. This is the more regrettable because the accuracy and completeness of the statistics in the reports are inferior to none, and superior to most work of a similar character in other countries. As frequently happens, private enterprise has stepped in where official action is wanting, and it is a pleasure to the geographer to turn to the recent maps of Mr. J. G. Bartholomew, especially the volume of his great Physical Atlas, the Atlas of Scotland published some years ago, and the Atlas of England and Wales which has just left the press. Both of the latter works contain general maps based on statistics that have not been

subjected to cartographic treatment before, and attention may be drawn in particular to the singularly effective and suggestive mapping of density of population. Another work similar in scope and no less creditable to its compilers is the Atlas of Finland, prepared by the active and enlightened Geographical Society of Helsingfors. In Germany, France, and Russia also examples may be found of good work of this kind, sufficient to whet the desire for the complete and systematic treatment of each country on the same lines.

It seems to me that the most useful application of youthful enthusiasm in geography, such as breaks forth in the doctorial theses of German universities, and is solicited in the programme of the Research Department of the Royal Geographical Society, would be towards the detailed comparison of the distribution of the various conditions dealt with statistically in Government Reports with the topographical map of selected areas. The work would, of course, not stop with the maps, for these, when completed, should be tested and revised as fully as possible on the ground, since geography, be the scale large or small, is not advanced by maps alone.

Such small portions of the co-ordination of existing surveys are, at the best, no more than fragments of a complete scheme, but they show what can be done with existing surveys and actual statistics, and indicate where these may be appropriately reinforced by new work. I have treated a special case of this kind pretty fully in papers to which it is only necessary to refer.* One section of the scheme outlined and exemplified in these papers is the distribution of rainfall viewed in relation to the configuration of the land, and with the active assistance of nearly four thousand observers in the British Isles, I feel that there is some prospect, though it may lie far in the future, of ultimate results from that study.

The system of botanical surveys now being carried on with signal success in many countries is in some ways even more interesting. It includes the mapping of plant associations and the discussion of their relation to altitude, configuration, soil, and climate. Such phenomena are comparatively simple, and the influence of the various modifications of geographical control is capable of being discovered. I need only mention the similar problems in animal distribution, both on land and in the sea, to the elucidation of which many able workers are devoting themselves.

Difficulties increase when the more complicated conditions of human activity are taken into account. The study of the geographical causes determining, or assisting to determine, the sites of towns, the lines of roads and railways, the boundaries of countries, the seats o

* *Geographical Journal*, 7 (1896), 345–364; 15 (1900), 205–226, 353–377.

industries and the course of trade, is full of fascination and promise. It has yielded interesting results in many hands; above all, in the hands of the leading exponent of anthropogeography, the late Prof. Ratzel, of Leipzig, whose sudden death last month is a grievous loss to geographical science. Had he lived he might have carried the lines of thought, which he developed so far, to their logical conclusion in the formulation of general laws of universal application; but that task devolves on his disciples.

Separate efforts in small and isolated areas are valuable, but a much wider basis is necessary before general principles that are more than hypotheses can be deduced. For this purpose there must be organized co-operation, international if possible, but, in the present condition of things, more probably on a national footing for each country. To be effective, the work would have to be on a larger scale and to be continued for a longer time, than is likely to appeal to an individual or a voluntary association. One experienced geographer could direct an army of workers, whose task would be to collect materials on a properly thought-out plan, and from these materials the director of the work could before long begin to produce results, probably not sensational, but accurate and definite, which is far better. The director of such a piece of work must be free to disregard the views of the collectors of the facts with which he deals, if, as may very well happen, these views are at variance with scientific principles.

A complete geographical description should commence with a full account of the configuration of the selected area, and in this I lay less stress than some geographers feel it necessary to do upon the history of the origin of surface features. The features themselves control mobile distributions by their form irrespective of the way in which that form was produced, and although considerations of origin are often useful and always interesting, they are apt to become purely geological. The second point to discuss is the nature of the actual surface, noting the distribution of such geological formations as volcanic rocks, clays, limestones, sandstones, and economic minerals, the consistency and composition of the rocks being the points to which attention is directed, the geological order or age an entirely subordinate matter. To this must be added a description of the climate as due to latitude, and modified by altitude, exposure, and configuration. Then the distribution of wild and cultivated plants in relation to their physical environment, and of the industries depending on them and on other natural resources. As the conditions increase in complexity, historical considerations may have to be called in to aid those of the actual facts of to-day. The lines of roads and railways, for example, are usually in agreement with the configuration of the localities they

serve ; but anomalies sometimes occur the explanation of which can only be found by referring to the past. The more transitory features of a country may have acted differently at different times in affording facilities or interposing barriers to communication. The existence of forests long since destroyed, of marshes long since drained, of mineral deposits long since worked out, or of famous shrines long since discredited and forgotten, account for many apparent exceptions to the rules of geographical control. In long-settled countries th mobile distribution do not always respond immediately to a change of environment. A town may cease to grow when the causes that called it into existence cease to operate, but it may remain as a monument to former importance and not wither away. As one ascends in the geographical system, the mobility of the distributions which have to be dealt with increases, the control of crust-forms upon them diminishes and non-geographical influences come more and more into play. It may even be that causes altogether out ide of geographical control account for the persistence of worn-out towns, the choice of sites for new settlements, or the fate of existing industries. If this be really so, I think it happens rarely, and is temporary. Geographical domination, supreme in simple conditions of life, may be modified into geographical suggestion ; but in all stable groupings or continuous movements of mankind the control of the land of the people will surely assert itself. How ? and To what degree ? are the questions to which the modern geographer must seek an answer.

A special danger always menaces the few exponents of modes of study which are not yet accepted as of equal worth with those of the long-recognized sciences. It is the Nemesis of the temptation to adopt a plausible and probably true hypothesis as the demonstrated truth, and to proclaim broad and attractive generalizations on the strength of individual cases. Geographers have perhaps fallen into the error of claiming more than they can absolutely prove in the effort to assert their proper position ; but the fault lies mainly at other doors. In geography it is not always easy to obtain exact demonstrations or to apply the test of accordance with fact to an attractive hypothesis ; and it is necessary to be on guard against treating such speculations as if they were truths. The methods of journalism, even of the best journalism, are to be absolutely discouraged in science. The new is not necessarily truer or better than the old simply because it is new, and we must remember that time alone tests theories. It is a danger to become too popular. The scientific study of geography should be carried on with as many safeguards of routine verification and patient repetition, and it may be within as high a fence of technical terminology, as, say, physiology, if the proper results are to be obtained.

Unfortunately, the idea is prevalent that geography is an easy subject, capable of being expounded and exhausted in a few popular lectures. I regret to see the growing tendency amongst teachers of geography to deprecate the acquisiton of facts, to shorten and "simplify" all chains of reasoning, to generalize over the heads of clamant exceptions, and even to use figures, not as the ultimate expression of exact knowledge, but merely as illustrations of relative magnitude. I quite allow that all this may be legitimate and laudable in the early stages of elementary education, but it should never pass beyond, and every vestige of such a system of evading difficulties should be purged from the mind of the aspirant to research.

The facts available for the advancement of geographical science are neither so well known nor so easily accessible as they should be. Much has been done towards the indexing of the current literature of all sciences, and geography is peculiarly fortunate in possessing the exhaustive annual volumes of the *Bibliotheca Geographica*, published by the Berlin Geographical Society, the carefully selected annual bibliography of the *Annales ae Geographie*, the critical and systematic chronicles of the *Geographische Jahrbuch*, and the punctual monthly lists and reviews of the *Geographical Journal* and *Petermanns Mitteilungen*, not to speak of the work of the 'International Catalogue of Scientific Literature.' A great desideratum is an increase in the number of critical bibliographies of special subjects and particular regions, prepared so carefully as to relieve the student from the necessity of looking up any paper without being sure that it is the one he requires to consult, and to save him from the weary labour of groping through many volumes for fragmentary clues. In addition to the sources of information usually catalogued in one or other of the publications cited, there exist in every country numbers of Government reports and quantities of periodical statistics too valuable to deserve their usual fate of being compiled, printed, stored away, and forgotten. There is scope for a great deal of hard but very useful and permanently valuable work, in throwing all these open to working geographers by providing analytical indexes. This would make it easier to discuss current Government statistics with the highest degree of precision, and to compare past with present distributions. All such statistics should be subject to a cartographical treatment no less rigidly accurate than the ordinary arithmetical processes.

The ultimate problem of geography may perhaps be taken as the determination of the influence of the surface forms of the Earth on the mental processes of its inhabitants. But a host of minor problems must be solved in cutting the steps by which that culmination may be reached. Let us first find, if possible, what is the true relation between

the elevation, slope, and exposure of land and climate ; then the exact influence of elevation, slope, soil, exposure, and climate on vegetation ; then the relation between all these and agriculture, mining, manufactures, trade, transport, the sites of towns, the political associations of peoples, and the prosperity of nations. After that we may consider whether it is possible to reduce to a formula, or even to a proposition, the relation between the poetry or the religion of a people and their physical surroundings. The chemist Chenevix wrote a book in two volumes a hundred years ago to demonstrate the inferiority of a particular nation, against one of whom he bore a personal grudge, and he was bold enough to attempt to justify the formula $C = f\lambda$, where C represented civilization, λ the latitude, and f a function so delicately adjusted as to make the value of C negative on one side of a channel 20 miles wide and positive on the other ! We cannot hope to arrive by any scientific process at so definite a formula, but the only way of getting there at all is by forging the links in a chain of cause and effect as unbroken as that which led from the " house that Jack built " to the " priest all shaven and shorn."

The last of the problems of geography on which I intend to touch is that of the training of geographers. So far as elementary instruction in geography is concerned I have nothing to say, except that it was bad, it is better, and it seems likely that it will be very good. But between geography as part of the education of a child and geography as the whole life-work of a man there is a gulf as wide as between nursery rhymes and the plays of Shakespeare. The training of an elementary teacher in geography should be more thorough and more advanced than that of a child, but it need not be of a different order. The teacher, whose special function is teaching, must, like a child, accept the facts of geography from the authorities who are responsible for them. Although the two gifts are sometimes happily combined, an excellent teacher may make but a poor investigator.

A would-be geographer has at present adequate scope for training in very few universities outside Germany and Austria. Great advances have been made in the United States, but it is only here and there amongst the universities that steps have been taken to secure men of the first rank as professors, who are not only channels of instruction, but masters of research as well. In the United Kingdom there are lecturers on geography at several universities and many colleges ; and although they have done good work, the system adopted fails, in my opinion, on a practical point—the lecturers are so inadequately paid that they cannot afford to give their whole time or their undivided attention to the subject with which they are charged. In such conditions progress cannot be rapid, and research is almost impossible. The absence of any

well-paid posts, by attaining which a geographer would be placed in a position equivalent to that of a successful chemist or mathematician or botanist, kills ambition. The man with his income to make cannot afford to give himself wholly to such a study, however great his predilection for it. The man with as much money as he needs rarely chooses " to scorn delights and live laborious days ; " and—with some bright exceptions—he has a tendency, when he turns to science at all, to study it rather for his own satisfaction than for the advance of the subject or the help of his fellows. We want some adequate inducement for solid scientific workers, well trained in general culture, and fitted to come to the front in any path they may select ; to devote their whole attention—and the whole attention of such men is a tremendous engine —to the problems of geography. The labourer is worthy of his hire, and the services of the most capable men cannot reasonably be expected if remuneration equivalent to that offered to men of equal competence in other subjects is not available. At a few American and several German universities such men can receive instruction from professors who are masters of the science, free to undertake research themselves, and to initiate their students into the methods of research—the best training of all. If the time should come when there are, perhaps, a dozen highly paid professorships in English-speaking countries, several dozen aspirants will be found, including, we may hope, a few more gifted than their masters all qualifying for the positions, stimulated by rivalry, and full of the promise of progress. This is not an end, but the means to an end. Rapid progress is impossible without the stimulus of the intercourse of keenly interested and equally instructed minds. Geography, like other sciences, has to fight its way through battles of controversy, and smooth its path by wise compromises and judicious concessions, before its essential theory can be established and universally accepted. We already see, though somewhat dimly, the great principles on which it depends, and they are becoming clearer year by year. As they are being recognized they may be applied in a provisional way to ccurrent problems of practical life. The world is not yet so fully dominated by the highest civilization, nor so completely settled, as to deprive geographers of an opportunity of showing how the settlement and development of new lands can best be carried out in the light of the permanent relationships between land and people discovered by the study of the state of matters of long-settled areas at the present day and in the past.*

The practical politician, unfortunately, thinks little of geographical principles, and hitherto he has usually neglected them utterly. Many

* For a development of this suggestion, see the author's 'New Lands' (London: Charles Griffin. 1901).

burning questions that have disturbed the good relations and retarded the progress of nations, even when they did not burst into the conflagration of war, would never have got alight had the consequences of some apparently trifling neglect, or some careless action, been understood beforehand as clearly by the man of affairs as by the student of geographcal principles. Perhaps, when geography has obtained the status in the world of learning to which its ideals and achievements entitle it, the geographer may more frequently be invited, when th occasion demands, to assist by his advice in saving his country from extravagance or disaster.

THE OPPORTUNITY OF THE GEOGRAPHER IN PROMOTING SCHOOL GEOGRAPHY.*

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Geographers the world over, however closely they may confine their investigations to some specialized field of the vast subject of geography, are all interested in making their favourite subject of more importance and value to the world at large. The development of research in geography, as in any field of science, depends largely upon the financial and moral support that can be obtained from public or private sources. That support is more readily given to a subject that is generally recognized as contributing to the welfare of mankind. Applied science is in many cases, therefore, more generously supported than pure science, because applied science contributes immediately to the betterment of some of the arts and sciences, while pure science does not seem so to do. Inasmuch, however, as progress in applied science involves the previous development of the principles of pure science to be applied in a practical way, it behoves workers in the science of geography to see to it that the value of their work, in either the pure or applied form, is made manifest to the public that the greatest progress may be made in all phases of geography.

The contributions of investigators in geography gathered from work in the field, the laboratory or the library, are the pure science results which aid in the constant better organization and better understanding of the science of geography. The largest application of pure geography is in educational geography, considering broadly that educational geography includes all geography which contributes to the general culture and special training of children and adults, whether that training is secured formally in some educational institution or informally through the reading of geographic literature. Training for securing the best results through an informal personal study of geography can only be obtained through a previous formal study of geography in schools and colleges. The work in geography in schools and colleges should therefore be so arranged and organized as to give the best training in the principles of geography, in the methods of classifying geographic facts, and in the use of standard reference works in geography.

Geographers can do no more helpful or valuable work than in assisting in the betterment of educational geography in schools and colleges, working with the officers responsible for the curricula, and

* Read at the Anniversary Celebration of the Royal Geographical Society of Australasia, Queensland, June 28, 1906.

showing how applied geography may be used in every day life in school and out. The better training of pupils in schools in this generation will mean the stronger support of both pure and applied geography by the adults of the next generation. Therefore geographers who aid in educational geography are building for the future and are contributing to the ultimate advancement of the science as much, if not more, than they could in any other way.

We cannot expect leaders in education to be experts in all fields of thought and but few educational experts have more than a general knowledge of geography. Only the expert geographer can view the whole vast field of the subject, see its perspective and judge as to the relative values of the phases that may possibly be made a part of the curriculum arranged for the training of beginning students of geography.

Hence geographers have a fundamental responsibility in reference to educational geography, a responsibility which they only can properly meet, and which presents problems of great difficulty.

No geographer in arranging a course of study for school or college classes can afford to think only of the best, most logical and most scientific order to be followed by adults in special work in scientific geography. He must always face the practical problems that confront the professional educator and frame his steps of progress in geography so as ultimately to lead to the best and most permanent results from the geographic standpoint. He must recognize all the time that the work he proposes must be within the abilities of the students of the age for which it is intended. Otherwise the work will fail of its purpose as a contribution to the knowledge and power of the students, and later work will consequently suffer. He must also bear in mind that but a very minor proportion of the students who begin geography in the earlier years of the school will ever become trained geographers. The larger number will drop out after a few years of work, and hence the course must be so arranged that at no matter what age the pupil leaves school he will have gained something that will help him in after life.

The problem is also difficult because most schools have few teachers qualified to teach geography as it might be taught, and hence the course outlined must be one that the layman can follow with success. Also beginning pupils are studying of necessity several topics at the same time. Hence the geography work to be most effective must be so planned as to help the work in history and literature and be closely related to the other work in science. It is not well to organize a school course to teach geography to children, but one to teach children and to prepare them for later life, in which preparation geography should receive strong and adequate attention.

It is for the geographer, therefore, to suggest the larger topics in geography that should be included in the school and college courses; to show the best order in which these topics or phases of the subject should be taken up to be of the best immediate usefulness and of the most permanent value to the pupils. He should also suggest in general the way in which the topics should be presented and aid teachers and educational leaders in getting a better grasp of the essentials of geography and in becoming able to teach geography more effectively. In those regions where school geography has come down through the generations unchanged, and where a spirit of conservatism keeps in the curriculum many topics of little or no use to the pupils in any way, or which are not essential elements of the science, it is for the geographer to show what topics can replace the old to the best advantage.

Leaders in education are very liable to jump at straws, to insert in their school courses in geography new materials, often of only passing interest, of little or no value in the child's training and frequently worthless geographically because some educational expert with no knowledge of geography as a science, has suggested such topics as valuable because they are so very different from the topics that have persisted through the generations.

After a geographer has fulfilled his duty as outlined above, he must allow the educational leader responsible for the curriculum as a whole, to take the initiative in deciding the amount of time to be devoted to geography and to arrange the work by years. The class-room teacher, within the confining but not galling limits set by her superior officers, should have free scope to teach her assignment of work as best she can, bearing in mind that effective results will only be obtained when the work of her year is based on the work of the previous years, and leads up to that of the next higher year. The details of class-room practice in reference to the teaching of any particular topics cannot be worked out by the geographer unless he has had experience as a class teacher, though he can usually offer many suggestions as to ways of teaching to be tried and tested in the class room The geographer can suggest the best reference books, the most valuable maps; he can show how maps should be used, how the globe can be made most valuable in the class-room and how the results can be tested from the standpoint of good geography.

With these considerations in mind, the question naturally arises as to what the experience of years and the mandates of good geography have determined is a good course in geography as a preparation for life or for higher work in geography as a science.

It is obvious that in the schools for pupils below thirteen or fourteen years of age, the course of study in geography should be a

unit, so divided and arranged as to be of the most value in the training of the youthful mind, and which when completed should lead up to the work of the secondary or high school for pupils from fourteen to eighteen years of age, as that work leads up to the college work.

Ideally, there should be a close and unbroken sequence of work in geography from the earlier years of school life through the university. In practice, at least in America, there is a more or less close knit unit in the elementary school. Unfortunately, however, there is a long hiatus between this work and the work of the secondary school. The secondary school work, furthermore, is mostly physical geography preparatory to college entrance examinations, with an occasional course in commercial geography. Regional geography, which is vital as a part of an adolescent's training for life, is practically omitted from the secondary school, and our graduates of eighteen go out into the world, or into college, with but little more knowledge of the general geography of the world than they had at the close of their elementary school course, four or five years before. This is neither training for further good work in geography in a college, or for using geography in everyday life. This great weakness in our plans is now being recognized, and it is probable that the ideal condition will gradually be approached more nearly, as the years go on.

The elementary school work is at present, therefore, the most thoroughly organized phase of geographic education. Experience and thought have shown that good geography, which can be approved by geographers, demands a certain order of study in the elementary schools if we would make our work practical, strong, and disciplinary at every step, and as a whole.

The first step in a logical course of study for children should naturally be, as has long been recognized in Germany and England, an analysis of the simpler elements of the vast geographical complex that surrounds a child in any locality, and which we call, for lack of a better name, *Home Geography.* Home Geography is, or should be, the fundamental division of a course of study because pupils must study the local and familiar phases of the subject in order to appreciate the geography of distant and unknown regions, which can only be interpreted as it can be compared with the known. If the method of science involves " proceeding from the known to the unknown on the well ordered assumption of the uniformity of nature " (Lloyd Morgan), then good science, as well as good teaching, requires that beginners should first study their home locality. Home Geography is one of the most difficult phases of geography teaching, because any locality presents such a vast series of possible geographic topics and relationships that might be studied. It is obvious, however, that attention

should mainly be devoted to those phases of the home environment with which the children come into the most personal contact, and the study of which will lay the best foundation for an easy and successful approach to the study of the world, or some remote area of the world. Geographers can therefore assist teachers materially by indicating what features of the home locality are most valuable geographically, by selecting the vital and world-true relationships, and showing how these may be studied so as best to lay a good foundation for all later work in the subject. No two localities have the same environment and hence no course of study can fit any two localities though the general plan of procedure and the general order of topics may be the same in many contrasted localities. Geographers can help the cause in no better way than by aiding teachers in securing a better understanding of their home locality, and showing how to distinguish between the simple and the difficult, and how to lead up to generalizations of permanent value.

Good teaching requires that the foundations laid in the early years should never have to be overturned. The ordinary generalizations of the textbooks are expressed in definitions. The geographer should aid in framing generalizations and definitions that not only define but which may be built upon without overturning the foundations as the years go on.

For instance, the well worn definition of a river as a "a body of water rising at a source and flowing into the ocean" is a bad definition, because it is only partly true and because it must be cast aside, when in later years, the idea of a river as including detritus and water in varying proportions, as rising in thousands of sources instead of at one, and as not, of necessity, reaching the ocean or any body of standing water is developed. This is but one instance, out of many that might be chosen, to illustrate the point that a definition should summarize the phenomena already studied in reference to a particular topic, and yet be expressed in such a way that future study may be an expansion of the earlier study, and not the replacement of the false by the true. Definitions should not only be true for the home locality but contain the essential ideas of the topic from a world-wide standpoint. Geographers can help good geography teaching vastly, by showing how true generalizations of permanent value may be built up through a study of the special cases most immediately at hand.

The study of Home Geography should lead up to an understanding of the world as a whole in order that beginners may see something of their relations to the inhabited portions of the globe, and have a background for the later detailed work on some of the continents. This approach to the world whole should be made through an expan-

sion of the Home Geography and there should be no abrupt break between these two phases of the subject. By a skilful use of the globe, which is assumed as a miniature representation of the world, children can be led to see their relations to other peoples and distant parts of the globe, just as easily and satisfactorily as the relations to local market gardens and manufacturing centres. Through the study of the products of commerce which contribute to their food, clothing or shelter, children may be led far afield geographically and yet feel that the work is personal in that they are studying their own geographical relations to the world.

A study of the simpler reasons why one locality or nation is dependent upon other distant regions for products in everyday use will lead naturally to certain generalizations in reference to world climate and regions of habitability. These generalizations, which may be summarized in the heat belts, give a basis for dividing any continent in later work. Generalizations as to shape and the broad climatic divisions of the world, as to the distribution of the continents in direction and distance in days' travel from the home locality are all that is necessary to make at this time. Such generalizations can be developed through the study of the relation of the world to the home locality and these are outgrowths of the normal educational method of studying the unknown through the known. It is not necessary at this time to study the relation of the world to the sun and moon or the motions of the earth or to make broad generalizations as to the divisions of the world into great highlands and lowlands. Such matters are not necessary at this stage, are too impersonal to be of advantage to the beginners, and, if studied, will be memorized and not worked out logically and meaningly as early generalizations should be. Teachers may have some difficulty in deciding on the regions of the world to be selected as contributing to the home geography and as the best centres through the study of which to develop the larger climatic features of the world. Geographers can be of great service, therefore, in helping to pick out the strategic points in the commercial geography of the world as related to the home locality, and in showing how these selected areas may be studied to the best advantage for the purpose in mind.

Untrained teachers will become too formal in their work, will fail to approach the study from the life side as it ought to be and will follow a text, if possible, instead of making the text their servant, as texts always should be

The larger part of the later work in school geography must, of necessity, be the study of the continents. It is usual to study certain of the continents, and in some cases all of them, twice. Unfortunately,

however, in many, if not the large majority of schools, the treatment of the continents, in both cycles, is from the same standpoint, so that the second treatment is merely an expansion of the first treatment. This means that the work in the second cycle is often dry and uninteresting to the pupils because they think they know all that is to be treated. Hence the work is ineffective and does not lead to the best educational results. The fact that many pupils leave school by the end of the fifth or sixth year requires that their own country should be treated early in the course. Those who remain through the elementary school should have as serious and complete a treatment of their own country as possible, as a climax to their school work in geography. The intervening years should be devoted to the other countries and continents, dividing the time according to the relative importance of the different regions from a world standpoint.

The work of necessity therefore covering the same general field throughout several years, good geography and good teaching demand that the method of approaching continental study shall not be the same throughout the long time devoted to this phase of the subject. The earlier treatment cannot be as severe as the later because the pupils are not capable of as intensive work. This work should also be as closely related to the earlier work in Home Geography and the study of the World as a Whole, as possible, so that the simple facts and relations already considered may be applied and developed. The point of departure therefore should be the lives and activities of the people as related to their environment. The work should be mainly a study of life consequences in a given region, through the study of which the physical causes may gradually be developed and shown to be of great importance. It is the life side of geography and not the formal physical side in which young children are most interested, and to which they will give the best attention. Because an adult expert geographer would naturally begin with the causal side and work out to the application of his principles in the interpretation of involved life consequences in commercial and political geography, is no reason why all students of any age should follow the same sequence. Children under 12 or 13 years of age are not capable of sustained scientific thinking, and gain little value from a method of study that works from causes to consequences in geography. On the other hand the analysis and comparison of life relations in different regions, through which the pupils gain a knowledge of the facts of geography in everyday life, gives a background of experience and knowledge on which better geography teaching can be based in the later years of the course. The constant bringing out of new phases of the same controlling influence leads the pupils to see the importance

of the physical side of geography and the necessity of formulating that side if they would learn to approach the subject of geography as the adult mind ought to approach it.

Hence, in the earlier years, only those large phases of surface and climate should be emphasized which are necessary as a setting for a study of the life relations of the people. The task then is to study the occupations, industries and interrelations of the people so as constantly to bring out the causal phases of the subject which make the work knowledge and not mere information.

Later comes a time in which naturally the principles of physical geography, which have been so constantly appearing, should be organized and systematized. Then a few months should be devoted to the study of the simpler phases of physical geography as such, in which reference is constantly made to the relations of people to their environment. Such a use of the facts already studied provides the best sort of review, because it necessitates the use of materials from a different point of view. Physical geography, or better, the *principles* of geography, should not be studied in an *elementary* school as an individual phase of geography. They should be given emphasis and brought for a time to the centre of the stage because the logical unity of the course, as a whole, demands it, and because the succeeding duty of certain continents or countries, from as serious a standpoint as the age and ability of the pupils permit, necessitates this emphasis. If rightly taught, physical geography becomes practically only a summary, slightly elaborated, of the essence of the earlier work, and a necessary foundation for the later study of certain parts of the world from a causal standpoint.

In the last years of the course causal geography should prevail. The work should be from causes to consequences, as the earlier work was from consequences to causes, thereby making the later work not merely an elaboration of the earlier, but an outgrowth of the earlier, as a climax to a unified course of study in which at every step the method of presentation has been adapted to the children's abilities, needs and interests.

The causal treatment should be from the large and general features of position, topography, soil, mineral wealth, etc., to the consequent distribution of industries, occupations, centres of population, routes of commerce and trade, etc. Such a method of presentation makes the principles of geography as prominent as the facts, prevents the work from merely being a training in memory skill, gives the pupils habits of study, shows them how to study more geography in later life, either personally or under tuition, and incidentally trains them in the elements of scientific thinking as can no other subject in the curriculum.

Pupils gain most from that course of study which makes them to the fullest extent masters of their own powers, and which does not lead them to become incomplete gazetteers of facts, many of which are erroneous and a large number obsolete. Causal geography rightly taught and for which the foundations have been carefully laid in the lower grades, is therefore stronger, both for present and for future needs, than mere memoriter work, in which things, and not the reason for things, are the central thought, and is better geography.

Good geography teaching demands some such a series of progressive phases in a course of study as this. At each stage the temptation to roam afield and to waste time on the unimportant details is very great, and only expert teachers, geographically trained, can test their plans from the standpoint of good geography teaching. Geographers, therefore, should help in organizing the subject as a whole, should show what points and principles to bring out, should assist the teacher in deciding between the important and the unimportant, should aid her in securing good maps, should guide her in her study of a map that she may aid her pupils in making map study essential, and should contribute in every way possible toward making geography work in schools of such a character that a geographer cannot stigmatize it as poor or valueless from the standpoint of good geography.

In America we are coming to follow an outline of work similar to that sketched above. Many of our geographers have given their time freely and abundantly to helping teachers and workers in school geography. The leaven has worked down from the top, as it always must in elementary education, and already the work in school geography has been largely revolutionized in little more than a decade. There have been many mistakes, large and small, and some of the suggestions made by expert geographers have proved unsatisfactory because beyond the abilities of the pupils. But the strong position of geography in our better schools, the much more general distribution of good geography teaching are largely due to the inspiring and suggestive work of the leaders in geography. This work has proved of great value to the science, as a science, and is destined to prove of greater value yearly, so that geography among the adults of the next generation will be in better repute than it has been in this.

Geographers everywhere can well afford to aid in such work for it brings good geography to the masses and not to the few merely, as it does if they confine themselves wholly to research. Geographers everywhere should recognize their opportunity, if not their duty in this regard, and put their shoulder to the wheel and work with the leaders of education and the teachers. Growth, improvement, strength, cannot come in school geography if the subject is left entirely to the

inexpert (geographically) workers in education. There is no more important phase of the subject than elementary school geography and no phase in which more good work remains to be done. Let us hope that geographers will come more and more to recognize its importance and help to explore, what is still to many geographers, a "terra incognita."

ON THE DEPTH, TEMPERATURE OF THE OCEAN WATERS, AND MARINE DEPOSITS OF THE SOUTH-WEST PACIFIC OCEAN.*

By SIR JOHN MURRAY, K.C.B., LL.D, D.Sc., F.R.S

INTRODUCTION.

A large amount of information has been acquired during recent years concerning that part of the ocean lying to the east of Australia, more especially in connection with the work of surveying ships engaged in examining the route for the British Pacific cable between British Columbia and Australia. It seems desirable to bring together all the available observations as they are of very great importance to all who take an interest in oceanography and the allied sciences.

In this communication it is proposed to deal with the observations as to the depth of the ocean, the temperature of the waters of the ocean, the marine deposits which cover the floor of the ocean, and the percentage of carbonate of lime, contained in these deposits.

The region under consideration (see Map I.) is that portion of the South Pacific bounded on the west by the coasts of Tasmania, Australia, and New Guinea; on the north by the equator; on the east by the meridian of 160° W. longitude; and on the south by the parallel of 50° S. latitude. The total water-surface within these boundaries is estimated at about 11,000,000 square miles. It will be observed that the maps used in illustration of this article do not include the whole of the region under consideration, but they cover by far the greater part of it, and serve to show all the more interesting physical features.

Within this region all the physical conditions are of the most varied description. Many different geological formations are represented on the land surfaces, including recent coral reefs and volcanic islands. There are many evidences of volcanic activity, and volcanic material is found spread over the bottom, sometimes in great abundance; volcanic debris, usually in the form of pumice and volcanic glass, was observed in every deposit-sample examined.

This region has been the subject of many interesting speculations regarding the distribution of land and water in former geological periods. It has been maintained by some naturalists (Hutton, Forbes, and others) that at one time it was the site of a great Pacific continent joining New Zealand and New Caledonia with Australia, and Forbes believes that Australia was formerly conjoined with the Antarctic continent through New Zealand and the Chatham Islands,

*Read at the Anniversary Celebration of the Royal Geographical Society of Australasia, Queensland, June 29, 1906.

and through Antarctica with South Africa and South America. Wallace in discussing the distribution of animals also refers in some detail to the supposed distribution of land and water in this region in past ages. A more accurate knowledge of the present-day conditions in this ocean will much assist those who endeavour to reconstruct the past history of our globe.

I. Topography of the Sea-Floor.

The floor of the ocean within the region under consideration shows probably greater diversity than in any similar area on the face of the globe, rising in some places to form submerged plateaus and banks, on which may be situated emerged islets, island groups and large islands, and sinking in other places to great depths, sometimes exceeding 5,000 fathoms. The depth map accompanying this paper (see Map II.) shows at a glance this remarkable diversity, the contour lines of depth being of the most sinuous description, great deeps alternating with shallow banks and ridges. A few of the main features exhibited by the map may be here alluded to. There are about two thousand soundings in depths exceeding 100 fathoms actually laid down on this map, but that number does not nearly represent the total number of soundings which have been taken into account in laying down the contour lines of depth, for so numerous are they in some localities that only a very small proportion could be laid down on such a small scale, and in these cases we have prepared large-scale maps of certain small districts, laying down the soundings in position before drawing in the contour lines. This was necessary in many places where search had been made for reported dangers, usually resulting in the discovery of banks more or less deeply submerged beneath the surface of the sea. Such a bank was discovered in the Coral Sea by Captain Balfour of H.M.S. "Penguin," and formed the subject of a short paper to which the reader is referred for further particulars.* Although the soundings are thus in certain localities crowded together in great profusion, there are, on the other hand, large stretches in which the soundings are few in number and the contour lines of depth could only be drawn in hypothetically, as, for instance, in the northern portion of the region between the Phœnix, Gilbert, and Solomon groups of islands.

One of the points of greatest interest in this region is the fact that, with one exception (viz., a sounding of 5,269 fathoms obtained by the U.S.S. "Nero" near Guam Island, one of the Ladrone group in the North Pacific, the deepest sounding known), it includes the greatest depths hitherto recorded

*See Murray, Balfour Shoal: a submarine elevation in the Coral Sea, *Scott. Geogr. Mag.*, vol. xiii. p. 120, 1897.

on the surface of the earth. There are three small depressions where the bottom sinks to more than 5,000 fathoms beneath the surface of the sea, two of them situated directly to the east of the Kermadec Islands, the depths being 5,155 and 5,147 fathoms, and the third, a little farther north, situated to the south of the Friendly Islands, where the depth is 5,022 fathoms. These great depths are known as the Aldrich and Oldham Deeps, the term "deep" being applied in recent oceanographical literature to those parts of the ocean where the depth exceeds 3,000 fathoms or three geographical miles. These three depressions form part of a remarkable series of seven, in which the depths exceed 4,000 fathoms, running in a line south-west from the Samoan group of islands towards the east coast of New Zealand. This deep rift in the earth's crust is thrown into greater relief owing to the fact that it runs practically parallel with, and comparatively close to, the shallow ridge running north-east from New Zealand, on which the Kermadec and Friendly groups of islands are situated. The peculiar depth conditions in the neighbourhood of this deep rift are associated with much volcanic activity, for the material brought up from the deepest soundings is largely made up of volcanic debris, so that they might be called Volcanic Muds, although we have preferred to call them Red Clays, because of the large amount of iron oxide and clayey material they contain, while the deposits from the shallow ridge and around the Kermadec and Friendly Islands are true Volcanic Muds and Sands. Further evidence of volcanic activity in this locality is furnished by the appearance a few years ago of an island made up of loose volcanic scoriæ to the east of the Friendly group; when first observed this island, which was called Falcon Island, was of considerable extent and rose to a height of several hundred feet above the sea, but the loose volcanic material was gradually washed away and spread out by the action of the sea, until ultimately the island disappeared beneath the waves, and its place is now occupied by a shoal, which in the future may be the foundation of a coral atoll.

The topography of the sea-floor between Australia and New Zealand is also extremely diversified, ridges and valleys running approximately in a north and south direction alternating with each other, the valley nearest Australia being the deepest, a sounding of 3,265 fathoms having been recorded comparatively close to the Australian coast. This deep valley, which is now known as the Thomson Deep, is broken up by several elevations which do not reach the surface of the sea, the latest additions to these elevations being the "Britannia Hills," discovered by Mr. Peake in 1903 in the S.S. "Britannia" to the east of Southport, Queensland, the sum-

mits of which rise to less than 300 fathoms beneath the surface of the sea, while they are surrounded by water exceeding 2,500 fathoms in depth.

The Balfour Shoal and Britannia Hills just mentioned, and similar submarine elevations surrounded by deep water, are a striking feature of those parts of the region which have been well sounded, and when dealing with the deposits of this region we shall have occasion to refer in greater detail to some of those submarine banks, in the neighbourhood of which volcanic material is usually found in abundance, sometimes apparently of quite recent deposition, sometimes more or less profoundly altered and associated with the peroxide of manganese in the form of nodules, coatings, or small grains. The region around the Fijis has furnished many examples of submerged banks, as well as the neighbourhood of the Coral Sea, and the sea between the coast of New South Wales across towards the Fijis by New Caledonia and Norfolk Island. There are also cases in which isolated deep soundings are surrounded by shallower water, but these cases seem to be far less numerous than the instances of submarine elevations rising from deep water.

It has already been stated that little information is available regarding the depth of the sea in the northern equatorial portion of the region. This is especially the case in the seas lying between the Fiji, Ellice, Santa Cruz, and New Hebrides groups; between the New Hebrides, Santa Cruz, and Solomon groups; and between the Solomon group, New Britain, and New Guinea; and in the open ocean, lying to the north of these seas, between the Solomon and Gilbert and between the Gilbert and Phœnix groups; and future soundings may make it necessary to modify considerably the contour lines as laid down on this part of the map.

In the excellent bathymetrical charts recently published at great expense by H.S.H. the Prince of Monaco, a deep is shown between the Chatham Islands and the coast of New Zealand. This is entirely an error, due to well authenticated soundings in 345 and 319 fathoms being misinterpreted as 3,450 and 3,190 fathoms, when converting fathoms into metres.

No attempt has been made to measure accurately the areas between the various contour lines of depth, but we roughly estimate that of the total water-surface

about 25 per cent is less than 1,000 fathoms in depth;
" 20 " " between 1,000 and 2,000 fathoms in depth;
" 40 " " " 2,000 " 3,000 " " "; and
" 15 " " over 3,000 " " "

Thus the area covered by less than 2,000 fathoms of water is estimated at about 45 per cent. (or less than half the total water-surface),

while the area covered by over 2,000 fathoms of water is about 55 per cent. (or more than half the total water-surface).

II. Temperature of the Waters of the Ocean in the South-West Pacific.

a. *Temperature of the Surface Waters.*

In his discussion of the results of the Challenger Expedition, Dr. Alexander Buchan shows that the area of high surface temperature of the ocean (over 80° Fahr.) does not quite circle the equatorial region of the globe, as it does not occur in the Pacific from long. 117° to 140° W., and that in the Western Pacific this area of high surface temperature extends east of Australia as far south as lat. 20° S. This striking extension southward of the high surface temperature is occasioned by the circumstance that, for eight months of the year, the line of lowest barometric pressure is there to the south of the equator, and necessarily accompanied by northerly winds, which propel into more southern regions the warmer waters of the surface. This point is insisted on as vital to the whole question of ocean circulation.

The influence of this high surface temperature on the temperature of the water at various depths beneath the surface may be here noted. Dr. Buchan states :—

"Turning now to the Pacific Ocean, we find that the line of least barometric pressure lies not north, but south, of the equator, from long. 160°E. to long. 130° W. An examination of the maps for the separate months shows that for eight months of the year this state of things substantially holds good, culminating in December, January, and February when barometric pressure is very low in Australia. In these months the north-east trades and ocean currents of the Western Pacific extend into the South Pacific to about lat. 15° S., as shown by the current charts now in course of preparation by the Meteorological Council. The isothermals for the depth of 100 fathoms show that the manner of the distribution of the temperature in the North and South Pacific is precisely the reverse of what obtains in the Atlantic. In the North Pacific the highest temperture, 70°, is restricted to two very small areas, whereas in the South Pacific the area marked out by the isothermal of 70° covers a very extensive region, and encloses another region, also very extensive, where the temperature exceeds 72°. In truth at this depth the South Pacific presents a region with a temperature above the general mean of the ocean, larger than the high temperature regions of all the other oceans combined. The *role* played by Australia, the low atmo-

spheric pressure of its warmer months mainly bringing about the result, deserves careful consideration."*

Referring to the specific gravities at a depth of 100 fathoms, Dr. Buchan says :—" In the Pacific Ocean, between lat. 40° N. and 40° S. and long. 150° E. to 130° W., the following are the results of the specific gravities :—

	North Pacific.	South Pacific.
Number of Observations	23	22
Highest	1.0260	1.0271
Lowest	1.0253	1.0260
Mean	1.0256	1.0264

thus showing a marked difference in the specific gravities of the ocean at this depth. Over the region of highest temperature, which is south of the equator, the specific gravities are all high, but over the North Pacific they are low. They are low also in the region of lowest temperature, 50°, being only 1.0257. It may be added that the same low specific gravity occurs in lat. 15° S. and long. 94° W., where, in respect of the south-east trades, upwelling is to be expected, but to the west of this point, where high temperatures rule, it rises to 1.0269. Hence the high specific gravities of the South Pacific convey down to this depth a temperature much greater than is done in the North Pacific, where the specific gravity is much less."*

The circumstances above pointed out with reference to the surface and subsurface waters govern the temperature conditions of the South-West Pacific, and determine the direction of currents along the eastern coast of Australia, where a warm current from the north is met, off the coast of New South Wales, by cold currents from the south.

In a paper published several years ago,‡ in which all the records of the Meteorological Office were made use of, it was shown that within this region between the equator and lat. 40° S. surface water temperatures as low as 48° F. (near New Zealand) and as high as 90° F. (in lat. 10° S.) are known ; extending the limits to 50° S. the range would be still further increased, for readings of 39° and 40 ° are recorded in that latitude. Thus within the region under consideration the known range of temperature at the surface exceeds 50° (from 39° to 90° F.). In the northern parts of the region (within the tropics) the range of temperature at the surface in any one position does not exceed 10° throughout the year ; farther south, extending from the shores of Australia and Tasmania eastwards beyond New Zealand, the annual range in any one position may exceed 10°, and

*Buchan, Report on Oceanic Circulation, *Phys. Chem. Chall. Exp.*, Part viii, p. 18.

*Buchan, *op. cit.*, p. 21.

‡Murray, on the annual range of temperature in the surface waters of the ocean, and its relation to other oceanographical phenomena, *Geographical Journal*, vol. xii., p. 113, August 1898.

off the east coast of Australia near Sydney the range approaches, if it does not exceed, 30°. This wide range of temperature is due to the warm Australian current mingling in this region with the cold Antarctic drift. In all areas like this, where a cold current occupies the surface at one time of the year and a warm current at another time, there is great destruction of life both in the surface waters and on the bottom, through the wide annual range and sudden changes of temperature, and in these areas there are always found in the deposits at the bottom of the sea much glauconite and many phosphatic nodules in process of formation, for instance, off the Atlantic coast of North America, off the Cape of Good Hope, and off Japan,*

b. *Temperature of the Intermediate Waters.*

We have collected together all the serial temperatures hitherto recorded in that part of the south-west Pacific now under consideration, and have set them forth in the following Table :—

*Mr. C. E. Wragge has prepared for me the following note on the air-temperatures and rainfall within this area :—The influence of the warm waters of the Australian current upon the climate and rainfall must not be overlooked, as it is certainly a factor figuring largely in the climatology of the coast of New South Wales, and enables condensation to take place during the passage of anticyclonic areas over the coast regions, where the rainfall is always greatest. In order to show the difference in temperature in the water where the Australian current circulates, and in regions free from such influence, the following table of temperatures is inserted as a means of comparing the temperature of the sea west of Australia with the ocean temperatures east of the continent, where the warm water flows and is finally incorporated with the north-eastern antarctic drift current. The air temperatures are also given, and the position where the observations were taken is indicated by the latitude and longitude :—

Latitude.	Longitude.	Air temperature.	Sea temperature.	
33° 28′ S.	102° 8′ E.	61.70°	62.78°	
36° 51′	150° 32′	69.62°	71.06°	east coast
36° 10′	104° 30′	57.92°	58.64°	
37° 51′	107° 21′	57.92°	58.64°	
37° 19′	153° 22′	67.64°	67.28°	east coast
39° 59′	109° 39′	55.76°	54.86°	
42° 38′	116° 42′	53.78°	51.98°	
43° 43′	124° 36′	51.26°	51.26°	
43° 40′	151° 39′	58.46°	58.28°	east coast
46° 44′	146° 67′	59.0°	54.86°	

From the above table it is observed that the readings on the east coast of the continent are higher than those on the west coast. The presence of the current is indicated by a difference of more than 7° in passing from 43° 40′ to 43° 43′. The warm water from the tropics exerts an influence upon the air temperature, for it is observed that the temperatures are correspondingly raised where the current flows. In view of this fact it might be suggested that the heated air off the south-eastern coast of Australia helps to augment the rainfall of the coast districts during periods of high barometer, when a downflow of cold air takes place from the upper regions of the atmosphere. This cold air coming in contact with the warm layer of atmosphere immediately over that portion of the sea where the current flows, would cause condensation which would lead to beneficial rain of a showery nature over the coast districts. Especially would this be so over the fertile districts of the south-eastern corner of New South Wales in winter, where the cold air from the snows of the Australian Alps would be blown across to the coasts by the west and south-west winds on the advancing side of the anticyclone, and by contact with the warm sea vapours further increased condensation and rain would result, to the eastward of the coast ranges. It therefore seems probable that the rains of winter over the regions referred to, when the barometer is steady at over 30 ins., are caused to a great extent by the influence of the warm current running along the coast, in conjunction with the downflow of cold air from above, and from the close proximity of the Australian Alps.

TABLE OF SERIAL TEMPERATURES.

Depth.	1 *Challenger.* April 4, 1874 36° 57′ 0″ S. 150 34′ 0″ E. 2200 fms.	2 *Challenger.* June 13, 1874 34° 19′ 0″ S. 151° 31′ 0″ E. 400 fms.	3 *Challenger.* June 16, 1874 34° 27′ 0″ S. 154° 57′ 0″ E. 2550 fms.	4 *Challenger.* June 19, 1874 36° 41′ 0″ S. 158° 29′ 0″ E. 2600 fms.	5 *Challenger.* June 22, 1874 38° 36′ 0″ S. 166° 39′ 0″ E. 1100 fms.	6 *Challenger.* June 23, 1874 38° 50′ 0″ S. 169° 20′ 0″ E. 275 fms.	7 *Challenger.* July 8, 1874 40° 28′ 0″ S. 177° 43′ 0″ E. 1100 fms.	8 *Challenger.* July 10, 1874 37° 34′ 0″ S. 179° 22′ 0″ E. 700 fms.	9 *Challenger.* July 14, 1874 29° 55′ 0″ S. 178° 14′ 0″ W 520 fms.	10 *Challenger.* July 17, 1874 25° 5′ 0″ S. 172° 56′ 0″ W 2900 fms.	11 *Challenger.* July 21, 1874 37° 53′ 0″ S. 163° 18′ 0″ E. 1975 fms.	12 *Challenger.* Aug. 3, 1874 19° 7′ 50″ S. 178° 19′ 35″ E. 610 fms.	13 *Challenger.* Aug. 12, 1874 19° 2′ 0″ S. 177° 10′ 0″ E. 1350 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	72.0	67.0	64.0	62.5	58.2	58.5	57.2	58.2	65.0	72.0	59.5	78.0	77.5
10		68.0		62.8									
20		67.8	63.2	62.5	58.1		56.5 [25]				59.8		
30		67.6		62.5									
40		67.2	63.0	62.0	57.8						59.0		
50	65.2	66.3		60.5		58.5	56.5		62.0			76.8	71.5
60		65.3	59.5	59.2	57.4						58.0		
70		64.2		58.0			56.5 [75]						
80		63.0	56.0	57.0	56.6						57.2		
90		61.8		56.4									
100	59.3	60.7	52.6	55.8	55.9	56.5	55.7	55.2	60.5	67.6	55.9	71.0	70.8
150	54.9					54.7	53.9		56.2			65.2	66.0
200	51.4	55.0	48.2	50.8	52.2	52.7	51.7	50.0	53.0	59.2	51.2	59.5	60.8
250												53.7	54.2
300	47.6	48.5	45.1	47.0	48.5		48.2	46.7	49.0	50.4	47.8	47.8	47.0
350												44.2	
400			42.8	43.8	45.3		45.4	44.8	45.7	44.0	44.9	42.3	42.0
450												40.9	
500			40.4	41.6	42.0		43.7	43.0	43.0	41.3	42.5	39.8	40.0
600			38.9	39.8	39.8		42.1	41.5		39.2	40.4	39.0	38.9
700			37.8	38.6	38.2					37.9	38.7		37.9
800			37.2	37.5	37.4					37.2	37.5		37.2
900			36.9	36.9	36.9					36.9	36.8		36.8
1000			36.6	36.5	36.5					36.7	36.4		36.4
1100			36.3	36.2						36.4			36.2
1200			36.0	36.0						36.2	35.7 [1250]		36.0
1300			35.7	35.7						36.0			
1400			35.4	35.4									
1500			35.1	35.1							34.8		
Bottom	34.5			34.4	36.4		37.2	40.0		34.3	34.7		36.0

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	14 *Challenger.* Aug. 15, 1874 18° 30′ 0″ S. 173° 52′ 0″ E. 1450 fms.	15 *Challenger.* Aug. 19, 1874 16° 47′ 0″ S. 165° 20′ 0″ E. 2650 fms.	16 *Challenger.* Aug. 21, 1874 15° 58′ 0″ S. 160° 48′ 0″ E. 2325 fms.	17 *Challenger.* Aug. 24, 1874 14° 47′ 0″ S. 153° 43′ 0″ E. 2450 fms.	18 *Challenger.* Aug. 27, 1874 13° 6′ 0″ S. 148° 37′ 0″ E. 2275 fms.	19 *Challenger.* Aug. 28, 1874 12° 42′ 0″ S. 146° 46′ 0″ E. 1700 fms.	20 *Challenger.* Aug. 29, 1874 12° 8′ 0″ S. 145° 10′ 0″ E. 1400 fms.	21 *Challenger.* Feb. 22, 1875 0° 39′ 0″ S. 138° 55′ 0″ E. 2000 fms.	22 *Challenger.* Mar. 1, 1875 2° 33′ 0″ S. 144° 4′ 0″ E. 1070 fms.	23 *Challenger.* Mar. 11, 1875 0° 42′ 0″ S. 147° 0′ 0″ E. 1100 fms.	24 *Gazelle.* July 28, 1875 3° 7.5′ S. 150° 22′ E. 1420 fms.	25 *Gazelle.* Aug. 11, 1875 3° 57′ S. 152° 10.7′ E. 680 fms.	26 *Gazelle.* Aug. 23, 1875 5° 45.5′ S. 152° 54.2′ E. ..
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	77.5	79.0	79.0	80.0	78.5	78.0	77.5	83.0	84.0	83.8	86.2	85.2	84.6
10								83.0	83.2				
20	76.0 [25]				77.0 [25]			83.0	83.0				
30								83.0	82.5				
40								82.9	82.1				
50	75.2	76.0		75.4	74.0	76.2	76.6	82.5	81.5	81.6	82.0	81.2	81.5
60								81.4	80.9				
70								80.0	80.0				
75	72.9				71.0		74.3						
80								78.3	78.4				
90								76.4	75.8				
100	69.7	71.5	71.1	72.8	67.5	69.5	70.8	74.0	72.8	77.1	70.2	70.6	76.0
150	64.0	65.0		61.8	60.4	61.5	62.5	56.0	57.8	64.0			
200	56.8	57.0	55.5	53.5	52.0	54.5	54.2	49.7	50.0	52.0	51.4	51.0	58.5
250		51.5		48.5	47.0	48.9	48.0			48.5			
300	45.2	47.5	45.2	45.5	44.0	45.0	44.3	45.1	45.2	46.2	43.8	43.8	47.4
350				43.2		42.8	42.1			44.6			
400	41.8	42.3	41.6	41.5	41.0	41.2	41.0	42.5	42.4	43.1			
450				40.5									
500	40.3	40.0	40.0	39.6	39.3	39.3	39.7	40.7	40.5	41.0	39.8		
600		38.5	38.9	38.8	38.3	38.4		39.2	39.2	39.7			
700		38.0	38.3	38.3	37.9	37.9		38.1	38.4	39.0			
800		37.4	37.7	37.8	37.4	37.5		37.3	37.9	38.2			
900		36.8	37.2	37.3	37.0	37.1		36.7	37.4	37.5			
1000		36.3	36.8	36.8				36.2		36.8			
1100		35.8	36.4	36.4	36.3	36.3		35.7					
1200			36.0	36.0				35.3					
1300		35.8	36.0	36.0	35.8	36.0		35.2					
1400			36.0	36.0				35.2					
1500		35.8	36.0	36.0	35.8	36.0		35.2					
Bottom	36.2	35.8	36.0	36.0	35.8	36.0	36.0	35.2	36.4	36.2	37.2	38.4	

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	27 *Gazelle.* Sep. 13, 1875 14° 52.6′ S. 156° 10.5′ E. ..	28 *Gazelle.* Sep. 14, 1875 16° 0.4′ S. 156° 38.2′ E. ..	29 *Gazelle.* Sep. 19, 1875 22° 21.0′ S. 154° 17.5′ E. 520 fms.	30 *Gazelle.* Oct. 21, 1875 28° 28.3′ S. 156° 1.8′ E. ..	31 *Gazelle.* Oct. 25, 1875 33° 40.0′ S. 166° 28.1′ E. 1525 fms.	32 *Gazelle.* Oct. 26, 1875 34° 0′ S. 169° 59.5′ E. 975 fms.	33 *Gazelle.* Nov. 12, 1875 35° 21′ S. 175° 40′ E. 597 fms.	34 *Gazelle.* Nov. 13, 1875 33° 16.2′ S. 176° 25.7′ E. 1480 fms.	35 *Gazelle.* Nov. 15, 1875 30° 52.8′ S. 177° 5.5′ E. 2270 fms.	36 *Gazelle.* Nov. 19, 1875 28° 21.8′ S. 179° 40.4′ E. 1600 fms.	37 *Gazelle.* Nov. 22, 1875 23° 24.7′ S. 179° 17′ E. 1750 fms.	38 *Gazelle.* Nov. 25, 1875 19° 9′ S. 179° 39.5′ E. 975 fms.	39 *Gazelle.* Dec. 5, 1875 15° 53.9′ S. 178° 11.7′ W. 1330 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	78.8	79.6	74.4	72.8	63.6	61.6	62.8	65.0	67.4	72.5	76.4	76.5	80.6
10													
20													
25													
30													
40													
50	76.2	76.2	71.0	63.8	60.0	59.0	60.4	59.2	64.2	65.8	72.2	74.4	77.4
60													
70													
75													
80													
90													
100	69.8	72.8	69.4	64.4	58.0	56.5	58.0	57.0	62.2	63.0	68.8	69.8	73.4
150													
200	52.2	55.0	57.2	58.2	54.5	50.8	52.2	51.0	59.6	58.6	62.0	58.8	59.6
250													
300	44.6	45.0	50.2	45.8	49.8	46.6	48.0	47.6	50.5	49.2	50.8	53.2	45.8
350													
400													
450							44.4						
500	40.0	40.0	41.0	44.0	42.8	41.8		42.2	43.8	47.2	45.5	40.6	39.0
600													
700					38.8	38.0		38.8	39.0		37.0	38.5	37.4
800													
900		36.5		39.2	36.8	37.0		36.6	37.4	36.6	36.8	36.4	36.4
1000													
1100					36.5			36.0		36.4	36.2		36.4
1200									36.2				
1300													
1400													
1500													
BOTTOM			41.0		35.8	36.5	41.5	35.4	35.5	35.4	35.2	36.2	36.0

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	40 *Gazelle.* Dec. 9, 1875 14° 52.4′ S. 175° 32.7′ W. 905 fms.	41 *Gazelle.* Dec. 13, 1875 18° 40′ S. 174° 9.5′ W. 510 fms.	42 *Gazelle.* Dec. 21, 1875 17° 4.6′ S. 172° 53′ W. 1575 fms.	43 *Gazelle.* Dec. 23, 1875 14° 28.1′ S. 172° 18.5′ W. 2600 fms.	44 *Gazelle.* Dec. 31, 1875 18° 24′ S. 168° 27′ W. 2735 fms.	45 *Gazelle.* Jan. 3, 1876 22° 57.3′ S. 165° 15.5′ W. 2740 fms.	46 *Gazelle.* Jan. 4, 1876 25° 50′ S. 161° 42.1′ W. 2780 fms.	47 *Egeria.* 1887 39° 36′ S. 142° 28′ E. 967 fms.	48 *Egeria.* 1888 34° 0′ 0″ S. 176° 56′ 0″ E. 1694 fms.	49 *Egeria.* 1888 31° 6′ 0″ S. 178° 22′ 0″ E. 2087 fms.	50 *Egeria.* 1888 26° 8′ 0″ S. 179° 20′ 0″ W. 612 fms.	51 *Egeria.* 1888 22° 50′ 0″ S. 176° 21½′ W. 760 fms.	52 *Egeria.* 1888 24° 26′ 0″ S. 175° 10′ 0″ W. ..
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	81.6	78.8	85.4	84.6	79.6	77.2	77.6		64.0	66.0	70.5	72.0	
10													
20													
25													
30													
40													
50	79.8	74.2	78.4	78.6	75.0	74.6	69.4						
60													
70													
75													
80													
90											60.7		
100	72.8	69.6	73.0	72.8	71.6	69.2	64.4	52.1	58.9	60.0		60.3 [160]	66.2
150													
200	59.5	61.0	61.8	56.0	60.2	59.8	60.0	48.2	53.8	55.2	58.8 [190]		57.6
250												52.0 [260]	
300	45.0	47.2	46.0	46.4	45.6	47.6	51.0	46.9 (uncor'd)	49.3	49.1	50.3 [290]		49.1
350												43.5 [360]	
400								45.3 (uncor'd)	46.8	47.0	45.9 (390)		43.3
450												44.0 [460]	
500	40.0		40.5	39.6		40.8	42.8	41.0	42.7	42.3	41.7 [490]	39.2 [560]	41.3
600								38.4	41.3	40.5		38·5 [660]	39.3
700	36.8		37.4			40.0	40.6	37.2 (uncor'd)	39.7	40.0			37.7
800								37.2 (uncor'd)	38.7	37.8			36.8
900	36.2		36.4	36.2		37.2	37.2			37.3			36.7
1000													
1100													
1200						35.6	35.6						
1300				35.4									
1400													
1500													
Bottom	36.2	38.2	34.8	33.8		33.8	33.8	34.3 (uncor'd)	35.2	35.5	40.2	37.9	

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	53 *Egeria.* Nov. 11, 1888 20° 19′ 0″ S. 177° 24′ 0″ W. 1539 fms.	54 *Egeria.* Nov. 11, 1888 19° 38′ 0″ S. 179° 14′ 0″ W. 849 fms.	55 *Egeria.* Nov. 13, 1888 19° 13′ 0″ S. 179° 1′ 0″ E. 1381 fms.	56 *Egeria.* Nov. 13, 1888 19° 13′ 0″ S. 178° 24′ 0″ E. 1425 fms.	57 *Egeria.* Nov. 14, 1888 20° 5′ 0″ S. 178° 4′ 0″ E. 1947 fms.	58 *Egeria.* Nov. 16, 1888 21° 48′ 0″ S. 177° 34′ 0″ E. 2218 fms.	59 *Egeria.* Nov. 16, 1888 23° 38′ 0″ S. 176° 52′ 0″ E. 2437 fms.	60 *Egeria.* May 2, 1889 34° 25′ 0″ S. 171° 13′ 0″ E. 772 fms.	61 *Egeria.* May 10, 1889 38° 34′ 0″ S. 175° 56′ 0″ E. 1628 fms.	62 *Egeria.* May 14, 1889 29° 51′ 0″ S. 177° 24½′ E. 2220 fms.	63 *Egeria.* Aug. 23, 1889 13° 0′ 0″ S. 173° 59½′ W. 2263 fms.	64 *Egeria.* Aug. 25, 1889 15° 0′ 0″ S. 177° 36½′ W. 839 fms.	65 *Egeria.* Aug. 25, 1889 14° 34′ 0″ S. 176° 52½′ W. 1282 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	75.5		76.1			73.0	72.0	64.0	67.0	69.0	82.5	79.5	79.0
10													
20													
25						70.0	70.3						
30													
40													
50	73.9		74.1			69.1	67.8					77.4	
60													
70													
75						68.0	65.7						
80													
90													
100	68.6	70.2	69.0		70.5	67.5				60.7	72.5	73.2	73.8
150								53.2 [161]				63.8	
200	61.5	60.6	59.7		60.0	61.0		71.0 [195]		56.9	52.0	56.8	58.0
250													
300	43.7	43.4	49.9		49.6					49.8	45.0		46.8
350				44.6 [380]									
400	42.9	43.2	43.2		43.7		43.7 [430]			45.4	42.5		41.4
450									43.6 [470]				
500		40.8	40.0		43.2						40.5		39.8
550	40.0 [536]												
600		38.6	39.0		39.0					40.6	40.0		39.0
650													
700		37.8	38.1		38.3	61.8 [725]				39.2	38.5		37.8
800		36.9	37.1		37.0	(uncorrected)				37.8	38.2		37.3
900			37.3				45.5 [936]			37.0	37.5		37.2
1000	36.6 [1039]						(uncorrected)						
1100													
1200						36.5 [1218]							
1300													
1400							35.8 [1436]						
1500													
1700						35.5 [1718]							
1900							35.4 [1936]						
Bottom	35.9	37.0	35.1	35.2	35.1	35.1	35.1		35.0	35.5	34.2	37.2	36.5

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	66 *Egeria.* June 20, 1890 33° 1′ S. 170° 6′ E. 2258 fms.	67 *Egeria.* June 27, 1890 27° 58¾′ S. 178° 27′ W. 1366 fms.	68 *Egeria.* June 29, 1890 25° 22′ S. 177° 28½′ W. 806 fms.	69 *Egeria.* Aug. 29, 1890 19° 32¾′ S. 179° 21¼′ E. 1655 fms.	70 *Egeria.* Sep. 1, 1890 18° 44¾′ S. 173° 29′ E. 1506 fms.	71 *Egeria.* Sep. 4, 1890 18° 2¼′ S. 167° 49¼′ E. 1556 fms.	72 *Dart.* Nov. 25, 1892 18° 11′ S. 167° 23′ E. 2790 fms.	73 *Dart.* Dec. 3, 1892 27° 10′ S. 162° 57′ E. 633 fms.	74 *Dart.* May 23, 1893 25° 39.7′ S. 165° 4.2′ E. ..	75 *Dart.* May 23, 1893 26° 15.2′ S. 164° 36.5′ E. 1580 fms.	76 *Dart.* May 24, 1893 24° 16′ S. 165° 58′ E. 2000 fms.	77 *Dart.* May 11, 1897 33° 10.5′ S. 152° 26.5′ E. 534 fms.	78 *Dart.* May 11, 1897 32° 53′ S. 152° 59′ E. 1631 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	65.0	70.0	70.0	73.8	74.8	77.9	82.0	75.0	75.5	74.5	75.0	65.1	71.2
10													
20									72.0	70.7	74.0		
25													
30													
40									71.7	72.8	70.4		
50		69.0											
60									68.2	71.2	69.5		
70													
75													
80									68.0	67.7	66.2		
90													
100		63.2	63.5						65.0	66.0	65.0	59.8	61.2
150	54.0 [160]												
200		57.0	56.5				50.0			59.0		52.5	52.0
250								55.6 [280]					
300		52.2	50.8	51.3	47.8 [330]					49.9			47.7
350													
400		45.6	45.4							47.2			
450						44.3 [425]							
500		42.2	41.7							42.7			
550													
600		40.1											
650													
700													
800		38.0											
900		37.2											
1000		37.1											
1100													
1200													
1300													
1400													
1500													
1700													
1900													
Bottom	35.7	36.7	37.2	36.7	36.4	35.9	35.5	41.1		36.0			36,0

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	79	80	81	82	83	84	85	86	87	88	89	90	91
	Dart.	*Dart.*	*Dart.*	*Dart.*	*Penguin.*	*Penguin.*	*Penguin.*	*Penguin.*	*Penguin.*	*Penguin.*	*Penguin.*	*Penguin.*	*Penguin.*
	May 13, 1897	May 14, 1897	May 14, 1897	May 15, 1897	July 15, 1893	Aug. 7, 1894	Aug. 7, 1874	Aug. 8, 1894	Aug. 9, 1894	Aug. 10, 1894	Aug. 11, 1894	Aug. 12, 1894	Aug. 12, 1894
	31° 7.2′ S.	29° 22.5′ S.	28° 59.5′ S.	28° 24.3′ S.	11° 16.7′ S.	23° 30.5′ S.	23° 17.6′ S.	22° 29.8′ S.	21° 7.3′ S.	19° 33.3′ S.	18° 35.1′ S.	18° 48.8′ S.	19° 0.6′ S.
	153° 43′ 0″ E.	153° 51′ 0″ E.	153° 57.5′ E.	154° 2.5′ E.	145° 14′ 0″ E.	153° 52.7′ E.	154° 33′ 0″ E.	155° 8.6′ E.	155° 21.6′ E.	156° 26.9′ E.	157° 10.5′ E.	157° 0.6′ E.	156° 49.2′ E.
	2565 fms.	465 fms.	1089 fms.	1300 fms.	790 fms.	660 fms.	470 fms.	1810 fms.	1762 fms.	1568 fms.	1758 fms.	884 fms.	980 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	71.0	73.5	72.6	70.0	79.0	73.0	72.0	74.0	73.8	73.0	74.8	73.8	75.0
10	70.5	72.9	73.1										
20	71.2	73.3	75.0										
25													
30	70.7	72.8	74.8										
40	71.5	71.0	72.8										
50	70.4	73.5	69.1										
60		73.3 [65]											
70													
75	69.3		67.8										
80													
90													
100	68.9		67.0	74.0		69.3	63.3	68.0	69.3	65.4	71.6	68.5	
150	64.3	63.3 [165]	62.3		64.2 [165]								
200	60.6		59.9	62.8		59.8	59.7	62.6	62.5	62.3	63.2	62.9	
250		52.2 [265]			52.0 [270]								
300	53.5		49.8	55.8		51.5	50.6	55.7	52.4	52.2	52.1	51.9	49.7 [310]
350		47.8 [365]											
400	47.3			50.0		45.9		45.9	47.2	46.6	45.2	45.3	
450													
500	44.1			46.2		42.0		42.1	42.1	41.4	41.7	42.1	
600									40.0	40.4	39.6	40.6	
700												38.5	
800								39.4	38.5	38.1	38.0		
900													
1000								38.7		37.0	36.2		
1100													
1200													
1300													
1400													
1500													
BOTTOM		44.4			37.5	39.9	43.6	34.7	34.8	35.5	35.0	37.1	36.8

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	92 *Penguin.* Aug. 17, 1894 22° 1.8′ S. 156° 42′ 0″ E. 690 fms.	93 *Penguin.* Aug. 18, 1894 24° 23.2′ S. 155° 46.7′ E. 2400 fms.	94 *Penguin* Sep. 8, 1894 18° 22′ S. 157° 58′ E. 1965 fms.	95 *Penguin.* Sep. 9, 1894 17° 14.5′ S. 158° 33.8′ E. 1968 fms.	96 *Penguin.* Sep. 10, 1894 16° 0.9′ S. 159° 18.6′ E. 1290 fms.	97 *Penguin.* Sep. 10, 1894 15° 53.3′ S. 158° 53.6′ E. 1912 fms.	98 *Penguin.* Sep. 11, 1894 14° 0.8′ S. 160° 15.3′ E. 1025 fms.	99 *Penguin.* Sep. 12, 1894 12° 17.1′ S. 161° 16.3′ E. 2100 fms.	100 *Penguin.* Feb. 17, 1895 10° 42.2′ S. 160° 42′ 0″ E. 2900 fms.	101 *Penguin.* Feb. 18, 1895 12° 10.5′ S. 159° 28.5′ E. 2373 fms.	102 *Penguin.* Feb. 19, 1895 14° 3.4′ S. 158° 16.3′ E. 1779 fms.	103 *Penguin.* Feb. 20, 1895 15° 9.4′ S. 157° 38′ 0″ E. 1708 fms.	104 *Penguin.* Feb. 21, 1895 16° 39.5′ S. 156° 37 .6 E. 1482 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	73.7	70.6	76.2	76.8	76.2	79.2	81.7	81.4	85.0	83.6	83.5	82.2	82.5
10													
20													
25													
30													
40													
50													
60													
70													
75													
80													
90													
100	70.6	68.6	71.5	71.0	71.8	75.0	76.8	76.2	76.0	73.2	76.7	78.5	75.7
150													
200	62.4	61.9	60.3	62.3	63.5	61.0	61.2	60.8	59.9	60.3	67.0	64.8	62.0
250													
300	53.8	53.6	51.2	51.6	53.2	50.4	49.0	50.6	46.7	50.0	51.0	51.0	50.5
350													
400	46.9	46.8	46.7	47.1	43.0	44.8	44.0	44.7	43.1	46.0	44.0	45.3	44.8
450													
500	42.7	43.2	45.3	42.9	41.5	41.2	42.2	42.0	41.0	40.2	41.2	41.7	42.2
600	40.4	41.0	40.0	40.0	40.0	40.0	40.4	40.0	39.8	39.3	41.1	41.5	41.7
700										38.7	38.7	39.1	39.0
800		38.6	38.2	37.8	37.4		39.0	39.6	39.5	38.6	37.8	38.0	38.2
900											37.7	38.0	38.0
1000		37.5	36.9	36.8	36.6			36.7			37.1	37.1	37.1
1100													
1200		36.1											
1300										37.3 [1373]			
1400													
1500		35.3											
1700													
1900									36.8	37.1 [1873]			
Bottom	39.2	34.0	35.2	35.4	36.0	36.4	36.8	35.5	35.1	37.0	35.3	35.6	36.1

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	105 *Penguin.* Feb. 21, 1895 17° 34.1′ S. 156° 2.5′ E. 1013 fms.	106 *Penguin.* Feb. 22, 1895 19° 0.8′ S. 154° 58.2′ E. 1594 fms.	107 *Penguin.* Feb. 23, 1895 20° 45.5′ S. 153° 50.5′ E. 1285 fms.	108 *Penguin.* June 27, 1895 38° 35.6′ S 159° 39.9′ E. 2775 fms.	109 *Penguin.* June 30, 1895 37° 7.6′ S. 168° 19.3′ E. 683 fms.	110 *Penguin.* July 1, 1895 36° 52.4′ S. 169° 56.2′ E. 1162 fms.	111 *Penguin.* July 4, 1895 35° 24′ S. 170° 53.5′ E. 1138 fms.	112 *Penguin* July 16, 1895 35° 27′ S. 178° 0.1′ E. 1524 fms.	113 *Penguin.* July 17, 1895 34° 18.7′ S. 179° 31.8′ E. 1587 fms.	114 *Penguin.* July 18, 1895 32° 48.6′ S. 179° 34.4′ W. 948 fms.	115 *Penguin.* July 19, 1895 31° 9.6′ S. 178° 3.4′ W. 2107 fms.	116 *Penguin.* July 20, 1895 29° 14.5′ S. 177° 31.6′ W. 1500 fms.	117 *Penguin.* July 22, 1895 25° 11.8′ S. 175° 46.4′ W. 2760 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	82.2	81.2	80.0	55.7	57.0	59.2	58.0	60.0	59.5	57.2	61.4	62.4	67.6
10													
20													
25													
30													
40													
50													
60													
70													
75													
80													
90													
100	75.0	74.0	73.0	55.5	56.3	51.0	52.0	58.0	59.0	55.5	60.2	55.0	67.0
150													
200	65.2	63.4	63.7	50.4	52.8	50.8		55.5	57.3	51.8	55.7	54.0	59.1
250													
300	52.7	53.0	52.3	47.7	49.3	49.0	47.8	51.6	49.0	47.9	50.2	47.9	51.7
350													
400	45.0	46.2	45.9	45.1	45.8	47.0	46.2	47.0			46.8		46.0
450													
500	41.9	42.6	42.3	43.2	44.5	41.5	43.4	45.0	44.0	43.0	43.2		42.7
600	39.8	40.6	41.6	41.2		41.1	42.2	42.6	42.1	41.5	41.7		40.6
700		39.1	39.2	40.6		39.9		41.2	40.2	40.2	39.9		39.0
800		38.8	38.9	38.7		38.8		39.2	38.9	38.3	38.9		38.0
900		37.0	37.4	37.2		37.6		38.0			37.6		37.2
1000		37.1	37.1	37.0		37.4		37.1	37.1		37.1		37.0
1100													
1200													
1300													
1400													
1500													
1700													
1900													
Bottom	37.1	35.1	35.9	34.5	41.0	36.2	37.0	36.1	36.1	37.1	34.5	35.6	34.1

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	118 *Penguin.* July 24, 1895 22° 51.6′ S. 174° 53.6′ W. 3132 fms.	119 *Penguin.* Aug. 1, 1895 19° 24.2′ S. 176° 19.3′ W. 1275 fms.	120 *Penguin.* Aug. 2, 1895 17° 25.8′ S. 177° 57.2′ W. 1445 fms.	121 *Penguin.* Aug. 3, 1895 17° 12.9′ S. 179° 41.8′ W. 800 fms.	122 *Penguin.* Aug. 3, 1895 17° 18′ S. 179° 56.2′ W. 491 fms.	123 *Penguin.* Aug. 3, 1895 17° 26′ S. 179° 50.3′ E. 1328 fms.	124 *Penguin.* Aug. 10, 1895 16° 23′ S. 178° 2.7′ W. 1497 fms.	125 *Penguin.* Aug. 16, 1895 15° 29.7′ S. 176° 3.9′ W. 1123 fms.	126 *Penguin.* Aug. 18, 1895 15° 12.9′ S. 174° 42.3′ W. 968 fms.	127 *Penguin.* Aug. 19, 1895 14° 44.8′ S. 173° 37.1′ W. 2634 fms.	128 *Penguin.* Aug. 19, 1895 14° 28.4′ S. 172° 48.4′ W. 2835 fms.	129 *Penguin.* Aug. 20, 1895 14° 32.3′ S. 172° 2.7′ W. 2622 fms.	130 *Penguin.* Aug. 21, 1895 16° 19.7′ S. 172° 3.8′ W. 3980 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	72.0	76.4	77.5	78.2	79.0	78.2	78.8	80.5	81.0	80.5	80.8	82.2	81.5
10													
20													
25													
30													
40													
50							78.5						
60													
70													
75													
80													
90					75.5 [91]								
100	68.0		76.0	76.1		74.4	77.2	78.8				80.0	79.2
150							69.8						
200	58.7	61.5	62.6	63.0		61.0	64.7	62.2	59.4		60.5	60.8	61.0
250													
300	49.8	51.2	50.2	53.1	52.7 [291]	49.1	50.5	48.1	58.2		46.6	48.5	48.7
350													
400	45.8	44.7	44.1	44.2		43.5	43.8	42.7	43.5		42.5	42.4	42.4
450													
500	42.4	41.2	43.7	41.2		41.2	43.7	41.3	40.4		40.5	40.5	40.2
600	40.9	39.2	39.1	40.5		40.4	38.3	40.4	38.7		39.7	40.5	38.6
700	38.0	38.2	38.2	38.3			38.0	37.9	37.9		39.2	38.5	38.0
800	37.2	37.5	38.2				37.7		36.0		37.3	37.4	37.6
900	37.1	36.9	37.2			37.2 [928]	36.9	37.1					37.3
1000	36.9	37.0	36.8				36.5	36.9				36.2	36.4
1100		36.4				36.7 [1128]							
1200													
1300													
1400													
1500													
1700													
[illegible]										33.2 [2088]			

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	**131** *Penguin.* Aug. 22, 1895 16° 46.8′ S. 173° 41.2′ W. 690 fms.	**132** *Penguin.* Aug. 23, 1895 18° 5′ 0″ S. 173° 42.1′ W. 804 fms.	**133** *Penguin.* July 21, 1896 8° 28.9′ S 179° 13.7′ E. 2003 fms.	**134** *Penguin.* Nov. 27, 1896 26° 41′ 0″ S. 177° 31.5′ E. 2327 fms.	**135** *Penguin.* Dec. 14, 1896 40° 12.6′ S. 160° 8.9′ E. 2620 fms.	**136** *Penguin.* May 2, 1897 14° 33′ 0″ S. 177° 37.3′ W. 1159 fms.	**137** *Penguin.* May 3, 1897 13° 16.9′ S. 176° 56′ 0″ W. 2198 fms.	**138** *Penguin.* May 4, 1897 11° 42.8′ S. 175° 51′ 0″ W. 2335 fms.	**139** *Penguin.* May 5, 1897 10° 8.7′ S. 174° 56.0′ W. 2330 fms.	**140** *Penguin.* May 6, 1897 8° 57.2′ S. 174° 3′ 0″ W. 2606 fms.	**141** *Penguin.* May 7, 1897 7° 27.7′ S. 173° 12.1′ W. 2790 fms.	**142** *Penguin.* May 8, 1897 6° 1.5′ S. 172° 20.2′ W. 2970 fms.	**143** *Penguin.* May 9, 1897 4° 52′ 0″ S. 171° 32.2′ W. 3247 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	79.0	76.4	81.3	70.5	63.0	82.1	81.8	83.2	84.0	84.3	85.0	84.4	84.5
10													
20													
25													
30													
50	78.0												
60													
70													
75													
80													
90													
100	77.0	73.0	77.0	62.8	52.2	75.4	70.5	72.6	74.6	77.6	74.0	77.0	75.0
150													
200	62.2	60.8	53.5	52.2	49.9		56.9	51.7	54.0	55.9	53.3		53.2
250													
300	48.3	48.0	47.0	49.1	47.2		45.5	45.1	46.1	48.8	47.6	47.3	47.6
350													
400	43.1	43.8	44.7	46.1	45.0	42.5	41.5	42.3	42.5	43.8	43.9	44.4	45.3
450													
500	41.0	40.8	41.0	43.0	43.1	40.0	40.6	40.2	42.0	41.5	41.3	41.3	42.0
600		39.2	39.5	41.1	41.0		38.6			39.8		39.7	40.4
700				39.1	40.0		38.3	38.0	38.8	38.1	39.1		39.0
800			37.0	38.0	38.6		37.4	38.3	38.5			42.2	38.3
900				37.6	37.1			37.4	37.7	37.3	37.4	38.3	37.3
1000			36.5		36.4		36.9	36.9	36.8	36.6	36.7	37.0	36.8
1100					37.1								
1200			37.0		36.8								
1300													
1400													
1500													
Bottom.		..		36.8	34.2	35.3	34.5	34.0		34.4	34.4	34.4	34.9

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	144 *Penguin.* May 12, 1897 4° 3.5′ S. 170° 49′ W. 2970 fms.	145 *Penguin.* May 13, 1897 3° 9.5′ S. 170° 4′ W. 3008 fms.	146 *Penguin.* May 14, 1897 1° 12.8′ S. 168° 7.3′ W. 3365 fms.	147 *Penguin.* May 14, 1897 0° 53.5′ S. 167° 48.7′ W. 3043 fms.	148 *Penguin.* Sep. 8, 1897 1° 11.2′ S. 163° 56.3′ W. 2960 fms.	149 *Penguin.* Sep. 9, 1897 2° 44.5′ S. 165° 25.4′ W. 2961 fms.	150 *Penguin.* Sep. 10, 1897 4° 6.7′ S. 166° 37.7′ W. 3027 fms.	151 *Penguin.* Sep. 11, 1897 5° 30.2′ S. 167° 59.1′ W. 3110 fms.	152 *Penguin.* Sep. 12, 1897 6° 46.8′ S. 169° 8.7′ W. 3220 fms.	153 *Penguin.* Sep. 14, 1897 9° 7.7′ S. 171° 27′ W. 2245 fms.	154 *Penguin.* Sep. 15, 1897 10° 20.5′ S. 172° 37′ W. 2310 fms.	155 *Penguin.* Sep. 16, 1897 11° 39.7′ S. 173° 57.1′ W. 2553 fms.	156 *Penguin.* Nov. 21, 1897 21° 2.3′ S. 179° 26.0′ E. 1969 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	83.5	83.5	84.0	83.7	80.7	80.8	82.7	83.5	83.8	85.2	83.2	81.8	76.0
10					80.7	79.5	82.8	83.5	81.5	83.3	83.5	82.8	75.7
20					80.2	80.1	82.5	82.8	82.8	83.5	83.8	83.2	75.8
25			81.5										
30					80.2	79.8	82.5	83.3	80.5	82.9	83.1	82.0	76.5
40					80.2	77.2	82.8	83.5	81.1	83.2	83.2	82.5	76.3
50			79.2		80.0	78.0	82.5	83.0	80.5	83.2	82.8	82.4	75.5
60													
70													
75			77.8		75.0	78.2	77.4	78.5	78.5	77.2	76.5	77.5	
80													
90													
100	72.3	69.5	61.5	62.7	65.7	64.7	68.8	69.8	71.0	71.5	72.0	73.6	71.0
150					59.6	57.1	56.0	57.5	56.8	65.0		61.4	
200	51.4	51.9		52.5	56.2	54.1	53.7	53.4	52.8	58.8	57.0	54.8	63.0
250													
300	46.2	46.5		45.8	48.7	47.9	47.5	46.7	47.0	48.5	47.4	47.2	53.8
350													
400	43.7	43.8		42.5	44.3	44.0	44.0	43.4	43.3	43.3	43.5	43.4	45.7
450													
500	41.8	41.3		41.0	42.4	42.3	42.2		41.8	41.3	41.8	41.5	42.4
600	40.8	40.6	40.0		40.7	40.3	40.4	40.3		39.5	39.9	39.8	39.1
700	38.8	38.8	38.9		39.3	39.3	39.1	39.2		39.0	39.4	39.3	38.8
800	37.8	38.0	37.8		38.3	38.5	38.8	38.3		38.0	38.2	37.9	37.8
900	37.0	37.1	37.3		37.7	37.7	37.8	37.8		37.3	37.4	37.0	37.0
1000	36.9	37.0	36.9		37.4	37.5	37.3	37.4		37.2	36.9	36.9	
1100													
1200													
1300													
1400													
1500													
Bottom	34.9	35.0	35.0		35.0	35.8	35.2	35.0	35.7	36.6	36.9	36.3	37.9

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	157 *Penguin.* Nov. 22, 1897 23° 16.6′ S. 179° 15′ E. 1788 fms.	158 *Penguin.* Nov. 22, 1897 23° 44.1′ S. 179° 9.7′ E. 1903 fms.	159 *Penguin.* Dec. 4, 1898 35° 1′ S. 171° 37.2′ E. 796 fms.	160 *Penguin.* Dec. 5, 1898 35° 57.1′ S. 169° 38.7′ E. 1298 fms.	161 *Penguin.* Dec. 6, 1898 36° 52.5′ S. 167° 15.4′ E. 704 fms.	162 *Penguin.* Dec. 7, 1898 37° 57.2′ S. 164° 23.3′ E. 878 fms.	163 *Penguin.* Dec. 8, 1898 39° 17′ S. 161° 0′ E. . .	164 *Penguin.* Dec. 9. 1898 40° 32.0′ S. 157° 25′ E. . .	165 *Penguin.* Dec. 13, 1898 22° 15.5′ S. 175° 32.3′ E. 2351 fms.	166 *Penguin.* Dec. 14, 1898 24° 59.6′ S. 174° 9.1′ E. 2429 fms.	167 *Penguin.* Dec. 15, 1898 26° 38′ S. 172° 26.5′ E. 2070 fms.	168 *Penguin.* Dec. 18, 1898 31° 18′ S. 163° 46.2′ E. 1010 fms.	169 *Penguin.* Dec. 19, 1898 31° 36′ S. 163° 13.8′ E. 770 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	74.5	73.3	62.2	63.3	63.0	62.2	61.8	60.5	77.0	76.0	75.5	70.8	71.0
10	74.0	73.5	62.5	63.0	63.5	61.8	61.8	59.8	77.5	73.8	75.3		
20	74.5	72.8	61.4	62.7	63.4	61.5	61.0	60.2	75.0	70.5	75.5		
25													
30	73.8	72.7	59.0	60.8	63.2	61.0	60.5	59.2	74.8	69.0	75.5		
40	74.3	72.2	58.2	58.7	63.2	60.5	56.0	58.0	73.4	68.0	74.5		
50	73.8	72.5	57.8	58.8	57.5	57.2	54.5	57.7	71.9	66.5	69.2		
60													
70													
75			57.4	58.8	56.7	57.2	55.2	57.0	71.8	65.5			
80													
90													
100	68.0	67.0	56.1	58.2	55.8	56.5	52.3	54.5	68.0	63.8	65.7		
150			53.3	54.9	53.7	54.3	51.0	52.3	65.5	60.0			
200	62.3	60.0	50.7	52.2	51.7	52.3	49.8	51.6	62.3	56.5	60.0		
250													54.1 [270]
300	54.4	52.6		50.1			46.8	48.0	51.4	49.2	51.3		
350													
400	46.5	45.7		46.3			45.8	46.0	47.1		46.8		
450													45.1 [470]
500	43.2	43.0		43.8			42.3	42.7	43.0	42.3	45.0	44.5 [510]	
600	39.8							41.0	41.0	40.4	41.2		
700	39.0						38.4	38.7	38.7	38.9	39.3	40.5 [710]	
800	37.8						37.8	37.8					
900	37.2						37.0	37.1					
1000	37.2						37.0	36.6					
1100													
1200													
1300													
1400													
1500													
BOTTOM	35.5	35.5	41.0	36.8	40.5	39.5			36.0	35.9	35.9	37.1	39.2

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	170 *Penguin.* Dec. 19, 1898 31° 56.9′ S. 162° 36.8′ E. 710 fms.	171 *Penguin.* Dec. 19, 1898 32° 12.4′ S. 161° 55.8′ E. 595 fms.	172 *Penguin.* Dec. 19, 1898 32° 24.7′ S. 161° 20.9′ E. 770 fms.	173 *Penguin.* Dec. 20, 1898 32° 41.5′ S. 160° 40.6′ E. 780 fms.	174 *Penguin.* Dec. 20, 1898 32° 57.9′ S. 160° 1.7′ E. 875 fms.	175 *Penguin.* Dec. 20, 1898 33° 4.3′ S. 159° 23.8′ E. 2250 fms.	176 *Penguin.* Dec. 21, 1898 33° 7.5′ S. 157° 40.2′ E. 1645 fms.	176*a* *Penguin.* Apr. 8, 1902 32° 26.7′ S. 167° 7.5′ E. 653 fms.	176*b* *Penguin.* Apr. 9, 1902 32° 40.5′ S. 165° 10′ E. 1768 fms.	176*c* *Penguin.* Apr. 10, 1902 33° 7.5′ S. 163° 16.5′ E. 469 fms.	176*d* *Penguin.* Apr. 11, 1902 31° 44.5′ S. 161° 24.5′ E. 763 fms.	176*e* *Penguin.* Apr. 13, 1902 31° 25.5′ S. 160° 53.2′ E. 778 fms.	176*f* *Penguin.* Apr. 12, 1902 30° 45.4′ S. 159° 50′ E. 843 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	71.0	70.8	71.0	69.0	71.0	68.4	68.5	68.0	71.6	68.2	69.6	71.0	71.0
5								68.0	70.3	67.0	66.5	71.1	
10								67.8	70.8	67.5	68.0	70.5	71.0
20								66.6	70.0	66.5	69.6	71.3	70.5
25													
30								66.0	70.5	66.8	68.7	70.5	70.8
40							68.0 [45]	63.5	68.5		69.9	71.7	70.8
50								61.9	68.5		69.0 [41]	71.5	69.5
60													
70			63.3										
75								58.2	66.7			70.3	68.4
80				61.3									
90													
100								56.6	65.0				
150													
200	56.3 [210]	57.2 [195]					58.9 [145]		57.4				
250							52.8 [245]						
300									51.3				
350			47.6 [370]		46.3 [375]		48.7 [345]						
400	46.1 [410]	47.8 [395]											
450							45.9 [445]						
500				46.9 [580]			43.2 [545]						
600							41.4 [645]						
700													
800													
900													
1000													
1100							36.9 [1145]						
1200						36.9 [1250]							
1300													
1400													
1500						35.4 [1750]							
Bottom	40.4	42.6	39.5	39.5	38.0	34.6	35.4	41.8	36.4	44.6	39.8	39.8	34.0

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	176g *Penguin.* Apr. 14, 1902 31° 30.7′ S. 154° 23.2′ E. 2560 fms.	176h *Penguin.* Apr. 9, 1903 34° 31′ S. 177° 20.2′ E. 1400 fms.	177 *Waterwitch.* May 5, 1895 34° 40′ S. 154° 3′ E. 2690 fms.	178 *Waterwitch.* May 6, 1895 34° 38′ S. 157° 22′ E. 2600 fms.	179 *Waterwitch.* May 7, 1895 35° 2.5′ S. 159° 27′ E. 2700 fms.	180 *Waterwitch.* May 9, 1895 35° 8.5′ S. 164° 13′ E. 630 fms.	181 *Waterwitch.* May 11, 1895 35° 0′ S. 170° 26′ E. 1135 fms.	182 *Waterwitch.* May 11, 1895 35° 14.4′ S. 169° 13′ E. 565 fms.	183 *Waterwitch.* May 13, 1895 32° 49′ S. 173° 37′ E. 1090 fms.	184 *Waterwitch.* May 14, 1895 31° 38′ S. 174° 4.7′ E. 1970 fms.	135 *Waterwitch.* May 15, 1895 29° 40.3′ S. 175° 11′ E. 2340 fms.	186 *Waterwitch.* May 16, 1895 28° 19.5′ S. 175° 34.7′ E. 2260 fms.	187 *Waterwitch.* May 17, 1895 25° 59.6′ S. 175° 33′ E. 2435 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	73.5	67.0	70.5	67.0	65.8	63.5	63.2	63.0	67.0	68.0	69.1	71.0	74.0
10	72.8			66.5	65.5	62.8	63.2	63.0	66.5	67.8	69.0	70.8	73.8
20	73.0			66.1	65.3	62.8	63.2	63.0	66.5	67.8	68.9	70.8	73.8
25								[illegible]	[illegible]				
30	74.0			65.9	65.3		63.2	62.5	66.5	67.8	68.8	70.8	73.8
40	72.8												
50	72.0			65.5	64.0		63.0	58.8	64.7	64.5	67.5	67.6	71.0
60							[illegible]						
70													
75	72.5			64.1	60.9		59.0	57.8	62.5	62.8	65.2	65.2	68.2
80													
90													
100	70.5	60.6	65.5	61.3	57.8		57.5	57.0	61.0	61.8	63.0	63.6	65.8
150				56.0	55.8		55.0		58.0	59.5	60.6	61.8	62.3
200	66.0	56.9	57.3	52.8	52.5	51.8			54.4		56.8	57.8	59.2
250													
300	56.0	52.4		49.0	48.9		48.6		50.1		50.0	50.6	50.2
350													
400	50.6	48.1											
450													
500	45.5	45.8	43.2	43.3	43.5		43.0		45.2		43.1	42.9	43.1
600		42.9											
700	41.2	40.8											
800		40.5	38.9	38.5	38.8				38.9		38.2	37.9	37.9
900	38.0	39.6											
1000													
1100													
1200													
1300													
1400													
1500													
BOTTOM	34.0	36.2	34.2	34.3	34.9	40.6	36.2	43.1	36.9	35.6	35.8	35.8	35.3

TABLE OF SERIAL TEMPERATURES.—*Continued.*

176g *Penguin.* Apr. 14, 1902 31° 30.7′ S. 154° 23.2′ E. 2560 fms.	**176h** *Penguin.* Apr. 9, 1903 34° 31′ S. 177° 20.2′ E. 1400 fms.	**177** *Waterwitch.* May 5, 1895 34° 40′ S. 154° 3′ E. 2690 fms.	**178** *Waterwitch.* May 6, 1895 34° 38′ S. 157° 22′ E. 2600 fms.	**179** *Waterwitch.* May 7, 1895 35° 2.5′ S. 159° 27′ E. 2700 fms.	**180** *Waterwitch.* May 9, 1895 35° 8.5′ S. 164° 13′ E. 630 fms.	**181** *Waterwitch.* May 11, 1895 35° 0′ S. 170° 26′ E. 1135 fms.	**182** *Waterwitch.* May 11, 1895 35° 14.4′ S. 169° 13′ E. 565 fms.	**183** *Waterwitch.* May 13, 1895 32° 49′ S. 173° 37′ E. 1090 fms.	**184** *Waterwitch.* May 14, 1895 31° 38′ S. 174° 4.7′ E. 1970 fms.	**185** *Waterwitch.* May 15, 1895 29° 40.3′ S. 175° 11′ E. 2340 fms.	**186** *Waterwitch.* May 16, 1895 28° 19.5′ S. 175° 34.7′ E. 2260 fms.	**187** *Waterwitch.* May 17, 1895 25° 59.6′ S. 175° 33′ E. 2435 fms.
°	°	°	°	°	°	°	°	°	°	°	°	°
73.5	67.0	70.5	67.0	65.8	63.5	63.2	63.0	67.0	68.0	69.1	71.0	74.0
72.8			66.5	65.5	62.8	63.2	63.0	66.5	67.8	69.0	70.8	73.8
73.0			66.1	65.3	62.8	63.2	63.0	66.5	67.8	68.9	70.8	73.8
							[illegible]	[illegible]				
74.0			65.9	65.3		63.2	62.5	66.5	67.8	68.8	70.8	73.8
72.8												
72.0			65.5	64.0		63.0	58.8	64.7	64.5	67.5	67.6	71.0
						[illegible]						
72.5			64.1	60.9		59.0	57.8	62.5	62.8	65.2	65.2	68.2
70.5	60.6	65.5	61.3	57.8		57.5	57.0	61.0	61.8	63.0	63.6	65.8
			56.0	55.8		55.0		58.0	59.5	60.6	61.8	62.3
66.0	56.9	57.3	52.8	52.5	51.8			54.4		56.8	57.8	59.2
56.0	52.4		49.0	48.9		48.6		50.1		50.0	50.6	50.2
50.6	48.1											
45.5	45.8	43.2	43.3	43.5		43.0		45.2		43.1	42.9	43.1
	42.9											
41.2	40.8											
	40.5	38.9	38.5	38.8				38.9		38.2	37.9	37.9
38.0	39.6											

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	188 *Waterwitch.* May 18, 1895 24° 8.5′ S. 176° 8.2′ E. 2490 fms.	189 *Waterwitch.* May 19, 1895 21° 12.2′ S. 177° 5.9′ E. 2235 fms.	190 *Waterwitch.* May 20, 1895 19° 9′ S. 177° 52.7′ E. 1102 fms.	191 *Waterwitch.* Sep. 17, 1895 18° 54.5′ S. 179° 51′ E. 1780 fms.	192 *Waterwitch.* Sep. 19, 1895 14° 37.7′ S. 178° 52 5′ W. 1118 fms.	193 *Waterwitch.* Sep. 20, 1895 12° 49.5′ S. 177° 29.7′ W. 1880 fms.	194 *Waterwitch.* Sep. 21, 1895 11°.26′ S. 176° 27.7′ W. 1985 fms.	195 *Waterwitch.* Sep. 25 1895 10° 59.8′ S. 176° 36.2′ W. 1910 fms.	196 *Waterwitch.* Sep. 30, 1895 15° 43.6′ S. 179° 43′ W. 820 fms.	197 *Waterwitch.* Dec. 4, 1895 20° 5.5′ S. 176° 24′ E. 1408 fms.	198 *Waterwitch.* Dec. 5, 1895 21° 58.7′ S. 174° 23.2′ E. 1060 fms.	199 *Waterwitch.* Dec. 6, 1895 24° 18.5′ S. 172° 21′ E. 2200 fms.	200 *Waterwitch.* Dec. 7, 1895 25° 41′ S. 170° 56′ E. 2060 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	75.2	78.0	81.0	75.2	80.7	81.5	82.7	84.0	81.5	77.0	76.5	74.3	73.3
10	74.0	78.0	80.5	75.0	80.4	81.0	82.4	83.5		77.0	75.7	73.8	71.4
20	74.0	77.8	80.4	74.5	79.6	80.7	82.3	82.8	80.0	77.0	75.3	71.5	70.5
25													
30	74.0	77.5	80.4	74.0	79.5	80.6	82.3						
40													
50	69.2	77.2	78.0	73.8	78.8	80.6	81.3	82.4	77.9	74.5	72.5	68.2	68.5
60													
70													
75	68.2	72.5	75.0	73.1	78.6	77.3	77.3	79.3	76.9	72.5	69.9	66.1	67.3
80													
90													
100	65.0	70.8	71.8	71.5	76.1	76.5	75.0	76.0	73.0	70.8	68.5	64.4	64.0
150	63.2	65.2	64.8	67.0	66.9	64.8	64.0	62.5	68.5	66.9	66.8	62.0	62.2
200	57.2	61.3	59.3	61.5		58.8	56.2	56.8	59.6	60.4	61.9	57.3	58.3
250													
300	49.2	49.2	48.8	50.0	46.8	45.8	45.9		48.1	48.7	51.6	49.0	50.8
350													
400													
450													
500	42.4	42.6	41.9	41.3	40.2	41.1	41.3		40.3	42.0	42.3	42.5	43.7
600													
700													
800	37.6	37.3	37.3	37.3	37.1	37.3	37.4			38.0	38.8	37.7	37.9
900													
1000													
1100													
1200													
1300													
1400													
1500													
Bottom	35.3	35.5	36.2	35.4	36.3	35.0	34.9	34.9	37.6	37.0	37.6	35.5	35.5

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	201 *Waterwitch.* Dec. 8, 1895 27° 52.5′ S. 168° 59.8′ E. 1900 fms.	202 *Waterwitch.* Dec. 9, 1895 29° 0.7′ S. 167° 36.3′ E. 820 fms.	203 *Waterwitch.* Dec. 10, 1895 29° 2.5′ S. 163° 59.5′ E. 1225 fms.	204 *Waterwitch.* Dec. 11, 1895 29° 3′ S. 161° 34.7′ E. 780 fms.	205 *Waterwitch.* Dec. 12, 1895 28° 50.2′ S. 158° 59 E. 1778 fms.	206 *Waterwitch.* Dec. 13, 1895 28° 47′ S. 157° 2.9′ E. 2515 fms.	207 *Waterwitch.* Dec. 14, 1895 28° 43.5′ S. 154° 11′ E. 1425 fms.	208 *Waterwitch.* May 17, 1896 33° 7′ S. 153° 34.7′ E. 2725 fms.	209 *Waterwitch.* May 18, 1896 32° 54′ S. 156° 9.5′ E. 1425 fms.	210 *Waterwitch.* May 20, 1896 31° 37′ S. 161° 53.5′ E. 780 fms.	211 *Waterwitch.* May 21, 1896 30° 14.2′ S. 164° 57′ E. 1855 fms.	212 *Waterwitch.* May 22, 1896 29° 33.3′ S. 166° 44.7′ E. 1740 fms.	213 *Waterwitch.* May 23, 1896 27° 49.7′ S. 168° 6.7′ E. 1785 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	73.2	72.0	71.6	73.0	76.0	78.2	78.2	70.5	70.2	72.0	70.0	70.5	72.0
10	69.3	68.8	71.1	72.0	74.5	76.6	77.2	71.0	69.5	71.8	70.8	70.5	71.8
20	68.7	67.7	68.9	70.9	71.8	75.0	75.0	70.5	69.0	71.0	70.5	70.5	71.5
25													
30									66.8	70.5			
40													
50	65.3	64.5	66.5	66.3	68.0	69.7	68.9	68.8	66.5	70.5	69.5	70.3	71.5
60													
70													
75	62.5	63.5	64.5	65.3	66.5	66.1	65.8	67.3	63.8	66.0	67.8	65.5	64.9
80													
90													
100	60.7	62.3	63.8	63.9	65.0	64.8	64.0	64.2	61.0	64.0	65.0	63.5	61.8
150	57.8	59.5		60.6	61.4	60.2	59.0	57.0	56.2	58.0	62.0	60.3	58.2
200	54.5	55.3	60.0	57.8	58.0	56.5	55.6	52.0	53.0	56.0	58.2	57.8	55.0
250													
300	49.9	50.7	53.4	50.6	51.5	50.6		48.7	47.9	49.2	53.2	52.2	50.6
350													
400													
450													
500	47.6	43.5	45.3	43.4	43.7	43.5		43.3	42.3	42.6	44.2	44.2	43.0
600													
700													
800	38.1		38.7		38.5	38.4		38.4	37.7		39.0	38.8	38.0
900													
1000													
1100													
1200													
1300													
1400													
1500													
Bottom	35.5	38.4	35.8	39.5	34.5	34.1	35.4	34.3	35.4	38.5	35.8	36.3	35.8

TABLE OF SERIAL TEMPERATURES.—*Continued.*

01	202	203	204	205	206	207	208	209	210	211	212	213
rwitch.	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*
8, 1895	Dec. 9, 1895	Dec. 10, 1895	Dec. 11, 1895	Dec. 12, 1895	Dec. 13, 1895	Dec. 14, 1895	May 17, 1896	May 18, 1896	May 20, 1896	May 21, 1896	May 22, 1896	May 23, 1896
52.5′ S.	29° 0.7′ S.	29° 2.5′ S.	29° 3′ S.	28° 50.2′ S.	28° 47′ S.	28° 43.5′ S.	33° 7′ S.	32° 54′ S.	31° 37′ S.	30° 14.2′ S.	29° 33.3′ S.	27° 49.7′ S.
59.8′ E.	167° 36.3′ E.	163° 59.5′ E.	161° 34.7′ E.	158° 59 E.	157° 2.9′ E.	154° 11′ E.	153° 34.7′ E.	156° 9.5′ E.	161° 53.5′ E.	164° 57′ E.	166° 44.7′ E.	168° 6.7′ E.
0 fms.	820 fms.	1225 fms.	780 fms.	1778 fms.	2515 fms.	1425 fms.	2725 fms.	1425 fms.	780 fms.	1855 fms.	1740 fms.	1785 fms.
°	°	°	°	°	°	°	°	°	°	°	°	°
73.2	72.0	71.6	73.0	76.0	78.2	78.2	70.5	70.2	72.0	70.0	70.5	72.0
69.3	68.8	71.1	72.0	74.5	76.6	77.2	71.0	69.5	71.8	70.8	70.5	71.8
68.7	67.7	68.9	70.9	71.8	75.0	75.0	70.5	69.0	71.0	70.5	70.5	71.5
								66.8	70.5			
65.3	64.5	66.5	66.3	68.0	69.7	68.9	68.8	66.5	70.5	69.5	70.3	71.5
62.5	63.5	64.5	65.3	66.5	66.1	65.8	67.3	63.8	66.0	67.8	65.5	64.9
60.7	62.3	63.8	63.9	65.0	64.8	64.0	64.2	61.0	64.0	65.0	63.5	61.8
57.8	59.5		60.6	61.4	60.2	59.0	57.0	56.2	58.0	62.0	60.3	58.2
54.5	55.3	60.0	57.8	58.0	56.5	55.6	52.0	53.0	56.0	58.2	57.8	55.0
49.9	50.7	53.4	50.6	51.5	50.6		48.7	47.9	49.2	53.2	52.2	50.6
47.6	43.5	45.3	43.4	43.7	43.5		43.3	42.3	42.6	44.2	44.2	43.0
38.1		38.7		38.5	38.4		38.4	37.7		39.0	38.8	38.0

TABLE OF SERIAL TEMPERATURES.—*Continued.*

Depth.	214	215	216	217	218	219	220	221	222	223	224	225	226
	Waterwitch	*Waterwi ch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*	*Waterwitch.*
	May 26, 1896	June 1, 1896	June 3, 1896	June 12, 1896	June 17, 1896	Nov. 5, 1896	Nov. 6, 1896	Nov. 9, 1896	Nov. 10, 1896	Nov. 30, 1896	Dec. 1, 1896	Dec. 2, 1896	Dec. 3, 1896
	24° 42.7′ S.	23° 13.7′ S.	23° 22 2′ S.	23° 21·7′ S.	21° 23.2′ S.	15° 45.7′ S.	15° 50.4′ S.	15° 32.2′ S.	15° 33.8′ S.	29° 39.2′ S.	29° 49.2′ S.	29° 42.5′ S.	30° 21′ S.
	169° 39.6′ E.	170° 7.2′ E.	170° 5.8′ E.	169° 26.4′ E.	170° 57.9′ E.	176° 35.2′ E.	176° 21.3′ E.	175° 20.5′ E.	175° 22.2′ E.	164° 15.5′ E.	161° 48.2′ E.	158° 24.4′ E.	155° 27.6′ E.
	1262 fms.	1238 fms.	1770 fms.	940 fms.	1342 fms.	1660 fms.	1700 fms.	1632 fms.	1672 fms.	1825 fms.	665 fms.	1070 fms.	2480 fms.
fms.	°	°	°	°	°	°	°	°	°	°	°	°	°
0	73.2	76.2	75.6	76.2	75.0	81.5	82.0	82.1	82.0	69.5	70.5	74.5	73.8
10	72.8	75.6	75.2	76.2	75.0	80.0	80.5	81.0	80.8	69.5	70.0	74.0	73.8
20	72.8	75.6	75.0	75.8	75.0	80.0	80.2	80.0	79.8	66.6	69.8	73.9	73.5
25													
30	72.8		74.7			80.0	80.0	80.0	79.2	64.9	69.3	72.2	72.0
40													
50	68.8	74.1	72.5	75.2	74.5	79.2	79.7	78.1	77.5	62.7	67.8	69.5	70.0
60													
70													
75	65.5	71.1	70.7	71.8	72.5	77.5	77.5	77.1	76.0	60.6	66.5	67.9	68.6
80													
90													
100	63.2	68.0	68.0	71.2	70.8	74.1	73.0	75.3	72.6	59.0	66.0	66.7	67.0
150	60.5		64.4	65.2	64.5	68.0	67.2	66.6	66.7	54.8	64.8	61.2	63.8
200	56.8		60.2	61.4	57.2	61.0	60.8	58.2	59.7	52.8	60.5	58.5	61.3
250									53.3	49.0	56.5		55.6
300	48.7		50.8	51.4	51.0	47.6	47.8	47.3	49.0	47.3	53.8		53.1
350													
400													
450													
500	41.3		41.9	42.6	41.2	40.2	39.7	39.9	40.0	41.9	43.6		43.9
600													
700													
800	37.8		37.1	37.2	37.0	38.0	38.0	37.9	37.4	37.2			38.3
900													
1000													
1100													
1200													
1300													
1400													
1500													
Bottom	36.0	35.9	35.2	36.6	35.3	36.0	36.1	35.9	35.8	35.3	40.8	36.4	33.8

It will be observed from this Table that no fewer than 234 serial observations are available, and we propose to discuss these in some detail. In the first place in order to show the general distribution of temperature throughout the region, we have prepared four temperature sections, three of them longitudinal sections from east to west, separated by 10° of latitude, and an oblique section from south-west to north-east.

Section No. 1 runs in an easterly direction from the coast of Australia, approximately in latitude 13° S.; the serials used in preparing this section, proceeding from west to east are Nos. 20, 19, 18, 17, 102, 101, 98, 99, 193, 137, 63.

Section No. 2 runs parallel to section No. 1 but approximately 10° farther south; in preparing this section we have made use of serials Nos. 84, 9, 85, 86, 92, 76, 217, 216, 215, 199, 198, 165, 188, 59, 158, 157, 37, 51, 118, 45.

Section No. 3 runs parallel to sections Nos. 1 and 2, but 10° still farther to the south, that is approximately in latitude 33° S. In preparing this section we have made use of serials Nos. 77, 78, 208, 209, 176, 175, 174, 173, 172, 171, 170, 31, 66, 183, 61, 34, 48, 113, 114, 115. The gradual widening out of the spaces between the isothermal lines in the more southern sections should be noted.

Section No. 4 runs obliquely from a point in deep water off the coast of New South Wales, in latitude 36° S. and longitude 157° E., to a point in deep water to the north-east of the Phœnix group of islands in latitude 1° S. and longitude 168° W. In preparing this section we have made use of serials Nos. 4, 178, 179, 175, 174, 173, 172, 171, 170, 210, 169, 168, 211, 203, 212, 213, 214, 200, 199, 198, 70, 14, 197, 13, 196, 192, 136, 137, 193, 194, 195, 138, 155, 139, 154, 140, 153, 141, 142, 143, 152, 144, 151, 145, 150. The widening out towards the south of the spaces between the isothermal lines should also be noted in this north and south section.

In these sections the vertical scale is exaggerated 500 times as compared with the horizontal scale; the slope of the bottom is therefore 500 times less steep than represented.

Different shades of red are used to indicate temperatures over 50° F. (the deeper the shade of red the higher the temperature), while different shades of blue are used to indicate temperatures under 50° F. (the deeper the shade of blue the lower the temperature). It is unnecessary to enter into a minute description of these sections; a glance will show that the warm water, represented by the red colour, forms a relatively thin surface stratum, the higher isotherms being crowded closer together in tropical regions and becoming more widely separated on proceeding farther and farther south. The isotherm of

50° in no case exceeds a depth of 350 fathoms, and the isotherm of 40° is never found deeper than 750 fathoms, so that the great mass of water deeper than 750 fathoms has a temperature under 40°, and in the deep water to the east of Australia and to the east of the Kermadec and Friendly Islands, the temperature is under 35°. A comparison of these sections with Dr. Buchan's maps of mean temperature at various depths published in the "Challenger Report on Ocean Circulation," shows a close agreement, though the temperature indicated in the sections is usually slightly higher than that shown on the maps of mean temperature.

The 234 serial temperatures given in the Table show as a general rule a gradual fall in the temperature with increase of depth from the surface down to the bottom. The Table contains, however, a few exceptions to this general rule, which may be here enumerated. Commencing with those exceptions which occur between the surface and 100 fathoms, we may note that the "Dart" (serial No. 82) records a rise of 4° (from 70° to 74°) between the surface and 100 fathoms, but this may perhaps be ascribed to a misprint. Proceeding to the less conspicuous examples, we find that in serial No. 2 the readings at 10, 20, 30 and 40 fathoms were higher than at the surface, the maximum difference being 1° at 10 fathoms. In serial No. 4 the readings at the surface, 20 fathoms and 30 fathoms were identical, while the reading at 10 fathoms was 0.3° higher. In serial No. 11 the reading at 20 fathoms was 0.3° higher than at the surface. In serial No. 30 the reading at 100 fathoms was 0.6° higher than at 50 fathoms. In serial No. 75 the reading at 40 fathoms was 2.1°, and at 60 fathoms 0.5°, higher than at 20 fathoms. In serial No. 79 the surface temperature was 71°, falling at 10 fathoms to 70.5°, rising at 20 fathoms to 71.2°, falling at 30 fathoms to 70.7°, and rising again at 40 fathoms to 71.5°, *i.e.*, 0.5° higher than at the surface. In serial No. 80 the surface temperature was recorded as 73.5°, falling at 10 fathoms to 72.9°, rising at 20 fathoms to 73.3,° falling to 72.8° at 30 fathoms and 71.0° at 40 fathoms, then rising to the extent of 2.5° at 50 fathoms, the temperature at 50 fathoms being given as identical with that at the surface. In serial No. 81 the surface temperature was 72.6°, rising at 10 fathoms to 73.1°, and at 20 fathoms to 75.0°, falling at 30 fathoms to 74.8° and at 40 fathoms to 72.8°. Thus the water from 10 to 40 fathoms was warmer than at the surface, the maximum difference of 2.4° being recorded at 20 fathoms. In serial No. 149 the surface temperature was 80.8°, falling at 10 fathoms to 79.5°, rising at 20 fathoms to 80.1°, falling at 30 fathoms to 79.8° and at 40 fathoms to 77.2°, rising at 50 fathoms to 78.0° and at 75 fathoms to 78.2.° In serial No. 150 the readings at 10 fathoms

and at 40 fathoms were 0.1° higher than at the surface, while at 20, 30, and 50 fathoms the readings were 0.2° lower. In serial No. 151 the readings at the surface, 10, and 40 fathoms were identical, while the reading at 20 fathoms was 0.7°, and at 30 fathoms 0.2°, lower. In serial No. 152 the reading at 20 fathoms was 1.3° higher than at 10 fathoms, and the reading at 40 fathoms 0.6° higher than at 30 fathoms. In serial No. 153 the reading at 20 fathoms was 0.2° higher than at 10 fathoms, and the readings at 40 and 50 fathoms were 0.3° higher than at 30 fathoms. In serial No. 154 the temperature at 10 fathoms was 0.3°, and at 20 fathoms 0.6°, higher than at the surface, and the reading at 40 fathoms was 0.1° higher than at 30 fathoms ; the temperature recorded at 40 fathoms was identical with that at the surface. In serial No. 155 the reading at 10 fathoms was 1°, at 20 fathoms 1.4°, at 30 fathoms 0.2°, at 40 fathoms 0.7°, and at 50 fathoms 0.6°, higher than at the surface. In serial No. 156 the reading at 10 fathoms was 0.3°, and at 20 fathoms 0.2°, lower than at the surface, while at 30 fathoms the reading was 0.5°, and at 40 fathoms 0.3°, higher than at the surface. In serial No. 157 the reading at 10 fathoms was 0.5° below that at the surface, at 20 fathoms it was identical with that at the surface, the reading at 30 fathoms was 0.7°, and the reading at 40 fathoms was 0.2°, below that at the surface. In serial No. 158 the reading at 10 fathoms was 0.2° higher than at the surface, and the reading at 50 fathoms was 0.3° higher than at 40 fathoms. In serial No. 159 the reading at 10 fathoms was 0.3° higher than at the surface. In serial No. 160 the readings at 50 fathoms and at 75 fathoms were 0.1° higher than at 40 fathoms. In serial No. 161 the reading at 10 fathoms was 0.5°, at 20 fathoms 0.4°, and at 30 and 40 fathoms 0.2°, higher than at the surface. In serial No. 164 the reading at 20 fathoms was 0.4° higher than at 10 fathoms. In serial No. 165 the reading at 10 fathoms was 0.5° higher than at the surface. In serial No. 167 the readings at the surface, 20 fathoms, and 30 fathoms were identical, while the reading at 10 fathoms was 0.2° lower. In serial No. 176b. the reading at 10 fathoms was 0.5° higher than at 5 fathoms, and the reading at 30 fathoms was 0.5° higher than at 20 fathoms. In serial No. 176c. the reading at 10 fathoms was 0.5° higher than at 5 fathoms, and the reading at 30 fathoms was 0.3° higher than at 20 fathoms. Serial No. 176d. is peculiar, the temperature recorded at the surface being 69.6°, falling at 5 fathoms to 66.5° (possibly a misprint for 69.5°), rising at 10 fathoms to 68.0°, and at 20 fathoms to 69.6° (identical with the surface reading), falling at 30 fathoms to 68.7°, rising at 40 fathoms to 69.9° (or 0.3° higher than at the surface), and falling to 69.0° at 41 fathoms. In serial 176e. the readings at 5, 20, 40, and 50 fathoms

were higher than at the surface (the greatest difference being 0.7° at 40 fathoms), while at 10 fathoms and at 30 fathoms the readings were 0.5° lower than at the surface. In serial No. 176f. the readings at 30 and 40 fathoms were 0.3° higher than at 20 fathoms. In serial No. 176g. the highest reading (74.0°) was recorded at 30 fathoms, being 0.5° higher than at the surface, 1.2° higher than at 10 and at 40 fathoms, 1.0° higher than at 20 fathoms, 2.0° higher than at 50 fathoms, and 1.5° higher than at 75 fathoms. In serial No. 181 the readings at the surface, 10, 20, and 30 fathoms were identical. In serial No. 182 the readings at the surface, 10 and 20 fathoms were identical. In serials Nos. 183, 184, 186, 187, and 188 the readings at 10, 20, and 30 fathoms were identical. In serials Nos. 190 and 194, the readings at 20 and 30 fathoms were identical, and only 0.1° lower than at 10 fathoms. In serial No. 193 the readings at 30 and 50 fathoms were identical, and only 0.1° lower than at 20 fathoms. In serial No. 197 the readings at the surface, 10 fathoms, and 20 fathoms were identical. In serial No. 208 the readings at the surface and 20 fathoms were identical, while the reading at 10 fathoms was 0.5° higher. In serial No. 210 the readings at 30 fathoms and 50 fathoms were identical. In serial No. 211 the reading at 10 fathoms was 0.8°, and at 20 fathoms 0.5°, higher than at the surface. In serials Nos. 212 and 218 the readings at the surface, 10 fathoms and 20 fathoms were identical. In serial No. 213 the readings at 20 and 50 fathoms were identical. In serial 214 the readings at 10, 20 and 30 fathoms were identical. In serial No. 215 the readings at 10 and 20 fathoms were identical. In serials No. 217, 223, and 226 the readings at the surface and at 10 fathoms were identical. In serial No. 219 the readings at 10, 20, and 30 fathoms were identical. In serial No. 221 the readings at 20 and 30 fathoms were identical.

Proceeding now to the exceptions to the general rule of decrease of temperature with increase of depth occurring in depths greater than 100 fathoms, we find that these exceptions fall under two categories : (1) Observations showing a rise in the temperature and (2) those showing a uniform temperature at successive depths. There are 15 examples belonging to the first category. In serial No. 51 the temperature was recorded as 0.5° higher at 460 fathoms than at 360 fathoms. In serial No. 54 the temperature at the bottom in 849 fathoms was recorded as 0.1° higher than at 800 fathoms. In serial No. 55 the temperature at 900 fathoms was recorded as 0.2° higher than at 800 fathoms. In serial No. 58 the temperature at 725 fathoms was recorded as 0.8° higher than at 200 fathoms. In serial No. 59 the temperature at 936 fathoms was recorded

as 1.8° higher than at 430 fathoms. In serials Nos. 106 and 119 the temperature was recorded as 0.1° higher at 1,000 fathoms than at 900 fathoms. In serial No. 120 the temperature at the bottom in 1,445 fathoms was recorded as being 0.2° higher than at 1,000 fathoms. In serial No. 123 the temperature at the bottom in 1,328 fathoms was recorded as being 0.2° higher than at 1,128 fathoms. In serial No. 133 the temperature was recorded as being 0.5° higher at 1,200 fathoms than at 1,000 fathoms. In serial No. 135 the temperature was recorded as being 0.7° higher at 1,100 fathoms than at 1,000 fathoms. In serial No. 138 the temperature at 800 fathoms was recorded as being 0.3° higher than at 700 fathoms. In serial No. 142 the temperature at 800 fathoms was recorded as being 2.5° higher than at 600 fathoms, and 0.9° higher than at 500 fathoms. In serial No. 156 the temperature at the bottom in 1,969 fathoms was recorded as being 0.9° higher than at 900 fathoms. Belonging to the second category we have thirteen examples, of which seven indicate a uniform temperature from a certain distance above the bottom down to the bottom, viz.:—

In serial No. 154	from 1,000 fathoms to the bottom in	2,310 fathoms.
,, ,, ,, 15	,, 1,100 ,, ,, ,, ,, ,,	2,650 ,,
,, ,, ,, 16& 17	,, 1,200 ,, ,, ,, ,, ,,	2,325 and 2,450 fathoms.
,, ,, ,, 18, 19 & 21	,, 1,300 ,, ,, ,, ,, ,,	2,275, 1,700, and 2,000 respectively.

The remaining six examples show a uniform temperature at intermediate depths, viz.:—

In serial No. 39	identical readings were taken at	900 and 1,100 fathoms.
,, ,, ,, 47 & 120	,, ,, ,, ,, ,,	700 ,, 800 ,,
,, ,, ,, 129	,, ,, ,, ,, ,,	500 ,, 600 ,,
,, ,, ,, 157 & 163	,, ,, ,, ,, ,,	900 ,, 1,000 ,,

Most of the exceptions noted in depths less than 100 fathoms show a rise in the temperature of less than a degree, but a rise is recorded of :—

1° between the surface and 10 fathoms.	2.1° between 20 and 40 fathoms.
1° ,, 4 ,, 75 ,,	2.4° ,, the surface ,, 20 ,,
1.3° ,, 10 ,, 20 ,,	2.5° ,, 40 ,, 50 ,,
1.4° ,, the surface ,, 20 ,,	

The majority of the exceptions in depths over 100 fathoms show a rise in the temperature of only one or two tenths of a degree, and may therefore be purely instrumental errors or errors in reading small scale thermometers. There are only five observations indicating in intermediate waters a rise in the temperature of more than half a degree, viz. :—

0.7° between 1,000 and 1,100 fathoms	1.8° between 430 and 936 fathoms
0.8° ,, 200 ,, 725 ,,	2.5° ,, 600 ,, 800 ,,
0.9° ,, 900 ,, 1,959 ,,	

The seven serial observations indicating a uniform temperature from a certain distance above the bottom down to the bottom have

already been mentioned. Six of these were taken by the "Challenger" in 1874, four in the Coral Sea, one to the west of the New Hebrides, and one off the north coast of New Guinea. The seventh was taken by the "Penguin" in 1897 to the westward of Gente Hermosa; on the following day the "Penguin" found the same temperature at 1,000 fathoms, falling to the extent of only about half a degree at the bottom in 2,553 fathoms. The "Challenger" observations in the Coral Sea pointed to the possibility of this basin being cut off from the general oceanic circulation of the Pacific by a barrier covered by about 1,300 fathoms of water, but no confirmation is afforded by subsequent observations.

Notwithstanding the exceptions noted above, the great majority of the serial observations conform to the general rule of fall of temperature with increasing depth, and in order to show the gradual decrease of temperature with increase of depth in the intermediate waters of this region the following Table has been prepared showing (1) the number of observations, (2) the range of temperature, and (3) the mean temperature, at intervals of 100 fathoms, from the depth of 100 fathoms down to 1,500 fathoms. For the sake of comparison we have inserted the mean temperature for the whole ocean, where these have been calculated by Dr. Buchan in his "Challenger Report on Ocean Circulation." The means calculated for the ocean as a whole are, as might be expected, always lower than the means calculated for the region under consideration.

Depth in Fathoms.	Number of Ob'ations.	Range of Temperature.	Mean Temperature.	Mean Temperature of the whole Ocean (according to Dr. Buchan)
		° °	°	°
100	195	from 51.0 to 80.0 F.	65.3 F.	60.7 F.
200	190	„ 48.2 „ 67.0 „	55.9 „	50.1 „
300	180	„ 43.8 „ 58.2 „	49.6 „	44.7 „
400	108	„ 41.0 „ 50.0 „	45.1 „	41.8 „
500	167	„ 39.0 „ 47.6 „	42.4 „	40.1 „
600	91	„ 38.3 „ 42.6 „	40.3 „	39.0 „
700	85	„ 36.8 „ 41.2 „	38.8 „	38.1 „
800	114	„ 36.0 „ 39.6* „	38.0 „	37.3 „
900	74	„ 36.2 „ 39.2 „	37.3 „	36.8 „
1,000	60	„ 36.2 „ 38.7 „	36.9 „	36.5 „
1,100	18	„ 35.7 „ 37.1 „	36.7 „	..
1,200	14	„ 35.3 „ 37.0 „	36.4 „	..
1,300	10	„ 35.3 „ 36.2 „	35.8 „	..
1,400	5	„ 35.2 „ 36.0 „	35.6 „	..
1,500	10	„ 34.8 „ 36.0 „	35.5 „	35.3 „

*A quite exceptional reading of 42.2° at 800 fathoms is probably an error, the temperature at 600 fathoms in the same serial being 39.7°.

Another interesting subject of enquiry is the rate or amount of fall in the temperature with increase of depth. In the surface waters down to 200 fathoms the fall of temperature evidently varies to an

extraordinary extent, as shown by the observations given in the Table; thus the amount of fall at the same position shown in the 195 cases where the temperature is recorded both at the surface and at 100 fathoms, varies from 0.2° to 22.5°, while the fall of temperature shown in the 188 cases where the temperature is recorded both at 100 and 200 fathoms varies from 0.2° to 25.1°. Between these extremes every gradation occurs, and it seems impossible to trace any relation between the latitude and the amount of fall in the temperature of the upper 200 fathoms. As a rule, however, a large fall is usually found in the tropics, and generally indicates movements of water in different directions, while the few cases in which a fall of less than 1° is recorded either between the surface and the depth of 100 fathoms, or between the depth of 100 fathoms and the depth of 200 fathoms, at the same time and in the same position, are all recorded south of the tropics. The mean difference between the temperature at the surface and at the depth of 100 fathoms in the same position is 7.34°, while the mean difference between the temperature at 100 and 200 fathoms in the same position is 10.1°. The observations therefore seem to show that the temperature between 100 and 200 fathoms may vary to a greater extent than between the surface and a depth of 100 fathoms. As we proceed into water deeper than 200 fathoms the temperature varies less and less, and the amount of fall as calculated at intervals of 100 fathoms gradually diminishes. This is well shown in the following table giving the minimum, maximum, and mean amount of fall in the temperature at intervals of 100 fathoms from the surface down to 1,000 fathoms, and the number of observations on which the figures are based.

Depth in Fathoms.	Number of Observations.	Minimum Fall of Temperature.	Maximum Fall of Temperature.	Mean Fall of Temperature.
		°	°	°
0 to 100	195	0.2	22.5	7.34
100 ,, 200	188	0.2	25.1	10.09
200 ,, 300	179	1.2	16.0	8.26
300 ,, 400	110	1.0	10.2	4.51
400 ,, 500	107	0.1	5.5	2.65
500 ,, 600	87	0.2	5.4	1.77
600 ,, 700	71	0.3	2.7	1.26
700 ,, 800	63	0.1	2.2	0.93
800 ,, 900	55	0.1	1.8	0.77
900 ,, 1,000	44	0.1	1.3	0.46

c. *Temperature of the Bottom Waters.*

In addition to the 207 observations of temperature at the bottom included in the Table of serial temperatures given in the preceding section, 812 isolated observations of the bottom temperature have

been recorded in this region of the Pacific, as shown in the following Table :—

Table of Isolated Observations of the Temperature at the Bottom.

Date.	Latitude. ° ′	Longitude. ° ′	Depth. fms.	Temp. F °
Challenger—				
12 June, 1874	34 3¼ S.	151 51½ S.	650	40.8
12 ,, ,,	34 8	152 0	950	36.5
17 ,, ,,	34 50	155 28	2600	34.5
14 July ,,	29 45	178 11 W.	630	39.5
15 ,, ,,	28 33	177 50	600	39.5
25 Aug. ,,	13 50	151 49 E.	2440	35.8
Egeria—				
No. 49, 1887	39 43 S.	140 51 E.	2335	34.1
,, 6, 1888	31 51	178 31	1801	35.2
,, 13, ,,	27 32	179 42	1686	35.3
,, 24, ,,	25 9	178 44 W.	871	37.2
,, 263 ,,	24 18	175 50	2030	34.5
,, 264 ,,	24 26	175 38	2449	34.5
,, 266 ,,	24 59	174 46	3110	33.7
,, 267 ,,	24 55	174 29	2990	33.7
,, 268 ,,	24 44	174 18	3006	33.5
,, 269 ,,	24 49	174 7	2889	33.6
,, 270 ,,	24 49	173 56	3036	33.7
,, 271 ,,	24 37	175 8	4428	33.7
,, 274 ,,	23 18	175 38	941	37.0
,, 275 ,,	23 12	175 40	596	40.2
,, 276 ,,	23 7	175 39	456	42.8
,, 299 ,,	21 9	175 31	863	36.8
,, 300 ,,	21 14	175 42	412	45.4
,, 301 ,,	21 19	175 53	1003	36.6
,, 302 ,,	21 24	176 3	1216	36.3
,, 393 ,,	21 29	176 13	1347	36.4
,, 304 ,,	21 46	176 19	1330	36.3
,, 305 ,,	21 48	176 30	1153	36.6
,, 306 ,,	21 44	176 32	1369	36.4
,, 307 ,,	21 44	176 37	1498	36.4
,, 308 ,,	21 44	176 41	1252	36.5
,, 309 ,,	21 44	176 45	1153	36.5
,, 310 ,,	21 44	176 49	1228	36.5
,, 311 ,,	22 8	176 39	1359	36.4
,, 312 ,,	22 8	176 33	1296	36.0
,, 316 ,,	21 40	176 44	1278	36.0
,, 345 ,,	20 40	176 10	1331	36.0
,, 351 ,,	19 24	179 52	1718	35.1
,, 355 ,,	20 56	177 55 L.	1780	35.2
,, 357 ,,	22 44	177 17	2314	35.0
,, 359 ,,	24 35	176 30	2481	35.5
,, 360 ,,	25 35	176 17	2476	35.4
,, 361 ,,	26 33	176 13	2484	35.5
,, 362 ,,	27 26	175 39	2594	35.5
,, 6, 1889	33 36	161 25½	946	51.0 (?)
,, 7 ,,	33 41	163 14½	496	49.0
,, 8 ,,	34 0½	166 21½	1656	35.6
,, 9 ,,	34 3	168 45½	1095	38.8
,, 10 ,,	34 6	169 46½	1186	38.5
,, 12 ,,	34 18	175 46	1098	36.3
,, 14 ,,	32 31	176 4½	2170	35.0*
,, 15 ,,	31 47	176 8½	2288	35.5
,, 16 ,,	30 12	176 34	2380	35.6
,, 17 ,,	29 52½	176 39	2390	35.5

Date.	Latitude. ° ′	Longitude. ° ′	Depth. fms.	Temp F. °
Egeria—				
No. 23 1889	28 29	177 46	2030	35.2
,, 24 ,,	26 15	179 15½	972	46.8(?)
,, 25 ,,	25 34	179 42	1272	35.9
,, 26 ,,	24 38	179 36 W.	1208	35.8
,, 30 ,,	22 39	178 6	1486	36.3
,, 32 ,,	20 25	173 53½	2089	35.0
,, 33 ,,	19 56	173 43	2225	34.5
,, 34 ,,	19 31	173 40	2235	34.6
,, 35 ,,	19 16	173 38	1795	35.0
,, 36 ,,	18 24	173 2	2525	34.5
,, 37 ,,	17 56¾	172 42½	3092	34.5
,, 39 ,,	5 21	171 38¼	3312	34.5
,, 40 ,,	5 58	171 23¾	3100	34.5
,, 41 ,,	6 45	171 17¼	2956	34.5
,, 42 ,,	12 32	171 23¼	2700	34.0
,, 43 ,,	11 52½	171 15¼	2664	34.0
,, 44 ,,	10 52½	171 18¼	2724	34.0
,, 45 ,,	10 24½	171 20¼	2680	33.5
,, 46 ,,	8 30¼	171 7½	2518	34.5
,, 47 ,,	7 52	171 1½	2766	34.0
,, 48 ,,	11 0½ S.	172 10¾ W.	2606	33.8
,, 49 ,,	11 35	172 49¼	2573	34.0
,, 50 ,,	12 16	173 16¼	2560	34.0
,, 53 ,,	13 38	175 23½	2394	32.5
,, 54 ,,	14 1	176 11½	1512	35.8
,, 57 ,,	15 20½	178 24¼	1209	36.5
,, 58 ,,	15 39	179 3¾	1410	36.0
,, 59 ,,	16 40¼	179 2½	805	38.0
,, 60 ,,	19 51	179 7½ E.	1700	35.6
,, 61 ,,	20 1	179 7½	1765	35.6
,, 62 ,,	20 9	179 17½	1876	35.8
,, 63 ,,	20 16	179 23	1839	35.6
,, 64 ,,	20 11¾	179 28	1828	34.9
,, 65 ,,	20 21½	179 55 W.	1565	35.9
,, 66 ,,	20 23	179 43	1456	36.1
,, 67 ,,	20 22¾	179 35¼	1392	36.1
,, 68 ,,	20 20	179 26	1240	36.2
,, 69 ,,	20 19¼	179 15½	1075	36.9
25 June, 1890	29 37	178 52¼	1966	35.5
26 ,, ,,	29 3¼	179 32¼	931	37.0
26 ,, ,,	28 42¼	179 4	1430	36.5
27 ,, ,,	27 30¾	178 16¾	1649	36.2
28 ,, ,,	26 37	177 57	1106	36.7
28 ,, ,,	26 10½	177 48½	1220	36.7
29 ,, ,,	24 43½	177 11¼	658	38.5
29 ,, ,,	24 20½	176 50¼	889	36.7
30 ,, ,,	24 0½	176 32¾	753	37.8
30 ,, ,,	23 45¼	176 24¾	282	54.5
30 ,, ,,	23 40½	176 23	193	60.5
4 July ,,	22 58¾	176 4¼	214	61.2
4 ,, ,,	22 59½	175 49¾	160	67.0
28 Aug., ,,	19 58	178 16¼	226	59.3
31 ,, ,,	19 13	175 31 E.	1780	36.5
2 Sept. ,,	18 19	171 44¾	1700	36.4
3 ,, ,,	18 5	169 54½	1190	36.7

*Another thermometer, which came up reversed, recorded temperature at bottom 32.5°.

Date.	Latitude.	Longitude.	Depth.	Temp. F.
	° ′	° ′	fms.	°
Egeria—				
3 Sept., 1890	18 1	168 58¾	695	38.9
5 ,, ,,	17 56¼	165 47¼	2525	36.4
12 ,, ,,	15 26	150 49½	800	38.4
13 ,, ,,	14 56½	149 47¼	999	37.4
13 ,, ,,	14 33½	148 58¼	1204	36.9
14 ,, ,,	14 6	147 59	1315	37.1
15 ,, ,,	13 7	146 13¾	1680	36.1
7 Decr., 1891	27 1.2	160 38.3	1003	37.0
3 ,, 1892	27 16	162 56	660	41.0
4 ,, ,,	28 29.5	162 0	864	37.5
5 ,, ,,	29 38	161 8	837	38.0
6 ,, ,,	30 35.2	159 46	845	37.8
7 ,, ,,	32 29.3	158 41	2317	34.2
Dart—				
2 Decr., 1893	27 27.5	161 6.2	970	38.0
21 Aug., 1894	25 33.5	163 17	715	38.5
5 Decr., ,,	26 39.6	159 33	168	60.0
Penguin—				
15 July, 1893	11 12.8	145 53.5	865	37.3
16 ,, ,,	11 7.6	146 39	985	36.7
16 ,, ,,	10 59.1	147 23	1437	35.0
17 ,, ,,	10 46.8	148 18.1	1310	35.5
17 ,, ,,	10 48.4	149 8.4	1140	35.0
18 ,, ,,	10 52.7	149 56.2	865	37.2
23 ,, ,,	10 31	153 30.8	1685	34.5
23 ,, ,,	10 14.8	154 14.8	2047	34.8
8 Aug., 1894	22 49.9	155 17.6	1760	34.9
9 ,, ,,	20 10	156 3.9	1740	34.5
10 ,, ,,	18 42.6	157 4.4	1785	35.4
11 ,, ,,	18 25.6	157 0.9	1763	36.2
11 ,, ,,	18 35.4	156 49.7	1760	35.5
11 ,, ,,	18 35.4	156 59.4	1798	35.0
11 ,, ,,	18 41.5	157 3.4	1772	35.4
12 ,, ,,	18 50.9	156 58.3	870	37.0
12 ,, ,,	18 56.2	156 57.8	836	37.5
12 ,, ,,	19 3.3	156 56.5	974	37.1
12 ,, ,,	19 10.2	156 54.9	1192	35.9
12 ,, ,,	19 11.5	156 49.1	1343	35.7
12 ,, ,,	19 6.1	156 49.9	1227	36.3
12 ,, ,,	18 59.5	156 43.3	1186	35.9
12 ,, ,,	18 52.1	156 41.7	1000	36.5
13 ,, ,,	18 52	156 33.5	1163	35.9
13 ,, ,,	18 46.7	156 39.1	1020	36.7
13 ,, ,,	18 46.7	156 48.7	1184	36.3
13 ,, ,,	18 44.1	157 3	1760	35.0
13 ,, ,,	18 44.8	156 59.6	1549	35.3
13 ,, ,,	18 42.3	156 52.2	1571	35.3
14 ,, ,,	18 33.3	156 39.5	1642	35.5
14 ,, ,,	18 42.3	156 42.5	1402	35.5
14 ,, ,,	18 49.2	156 42.5	974	36.9
14 ,, ,,	18 53.2	156 50.7	910	37.3
14 ,, ,,	18 59.8	157 1.9	854	37.6
14 ,, ,,	18 49.5	157 12.6	1645	34.9
15 ,, ,,	18 41.8	157 7.8	1713	35.3
15 ,, ,,	18 41.3	157 19.5	1650	35.5
15 ,, ,,	18 53.5	157 6.9	1570	34.8
15 ,, ,,	19 2.7	157 4.6	1000	36.7
15 ,, ,,	19 4.2	157 12	1412	35.7
15 ,, ,,	19 9.2	157 31.1	1527	35.4
16 ,, ,,	1 50.8	156 54.6	1552	34.5
16 ,, ,,	20 45.6	156 40.8	1407	35.7
17 ,, ,,	21 49	156 5.7	950	37.5

Date.	Latitude.	Longitude.	Depth.	Temp. F.
	° ′	° ′	fms.	°
Penguin—				
17 ,, ,,	22 32.1	156 38.7	1085	36.6
17 ,, ,,	23 2.3	156 36.2	1085	36.6
18 ,, ,,	23 25.5	156 23.3	1020	36.7
6 Sept., ,,	21 53.2	155 1.7	1800	34.6
6 ,, ,,	21 36.7	155 32	1745	34.6
8 ,, ,,	18 45.6	157 35	1515	35.3
8 ,, ,,	17 59.1	157 30.4	1845	35.5
8 ,, ,,	17 36.3	157 9.9	1525	35.8
9 ,, ,,	17 1.6	158 10.2	1612	35.8
10 ,, ,,	14 46.3	159 27	1095	36.6
11 ,, ,,	13 7.6	160 39.3	1454	36.6
12 ,, ,,	11 29.5	161 46.5	2750	36.1
13 ,, ,,	11 10.6	162 16.1	2240	36.2
13 ,, ,,	10 57.6	162 21.9	508	41.2
13 ,, ,,	10 50.8	162 25	230	58.2
6 Jan., 1895	11 14.5	154 56	990	37.0
17 Feb. ,,	11 12.6	160 4.5	1507	36.0
17 ,, ,,	11 33.3	159 51.3	805	38.2
18 ,, ,,	12 59.1	159 4.5	1552	35.8
20 ,, ,,	16 13.7	157 25.6	1220	36.0
21 ,, ,,	18 11.5	155 34.7	1060	36.6
22 ,, ,,	19 52.5	154 26.7	1584	35.6
4 June ,,	41 30.5	148 51.5	865	37.5
4 ,, ,,	40 58.4	148 58	1590	35.8
25 ,, ,,	36 21.9	156 8.2	2660	34.5
26 ,, ,,	37 28.4	158 6.9	2700	34.5
28 ,, ,,	38 14.7	161 30.7	2688	34.8
29 ,, ,,	38 8.3	163 56.7	1418	38.8
29 ,, ,,	37 26.8	165 26.1	910	39.1
30 ,, ,,	37 21.5	166 57.1	547	45.3
16 July, ,,	35 2.2	178 51.3	991	37.0
16 ,, ,,	35 2.2	178 51.3	1035	37.0
17 ,, ,,	33 34.5	179 56.3 W.	1052	37.0
18 ,, ,,	32 7.2	179 6.2	304	49.0
18 ,, ,,	31 58.2	178 58.5	561	41.4
19 ,, ,,	31 45.5	178 47.6	1005	37.0
19 ,, ,,	31 33.5	178 35.3	1337	36.1
19 ,, ,,	30 48.2	178 15.2	1157	36.5
19 ,, ,,	30 13.6	177 59.5	1200	36.3
20 ,, ,,	29 35.3	177 41.1	1547	35.6
20 ,, ,,	28 24.6	177 4.1	1728	35.2
21 ,, ,,	27 31.6	176 39.6	1673	35.5
21 ,, ,,	26 40.2	176 16	1878	35.6 (?)
22 ,, ,,	25 52.3	176 4.7	1975	35.0
24 ,, ,,	22 21.2	174 36	2547	34.2
24 ,, ,,	21 55.3	174 33.3	2120	34.5
25 ,, ,,	21 20.4	174 39.9	971	37.1
25 ,, ,,	21 15.8	174 43.8	833	37.6
25 ,, ,,	21 13.1	174 48	737	38.3
31 ,, ,,	20 12.7	175 36.5	1197	37.0
1 Aug., ,,	18 52.7	176 40.1	928	40.6
1 ,, ,,	18 22.9	177 8.1	1211	36.6
2 ,, ,,	17 55.6	177 31.7	1320	37.0
2 ,, ,,	17 1.2	178 18.2	1187	36.3
2 ,, ,,	16 38.2	178 40.6	398	44.6
2 ,, ,,	16 38	178 47.4	538	39.8
2 ,, ,,	16 38	178 56.5	721	37.8
2 ,, ,,	16 39	179 5.8	788	38.5
2 ,, ,,	16 45.5	179 14.2	771	38.4
2 ,, ,,	17 2.7	179 31.4	835	36.8
3 ,, ,,	17 35.5	179 34.2 E.	1432	36.7
3 ,, ,,	17 42.9	179 21.2	957	37.0

PENGUIN—

Date.	Latitude.	Longitude.	Depth.	Temp. F.
	° ′	° ′	fms.	°
8 Aug. 1895	17 51.8	179 12.7	650	39.4
3 ,, ,,	17 59.4	179 4.1	753	38.2
3 ,, ,,	18 12.2	178 50.4	755	38.2
4 ,, ,,	18 15.8	178 40.1	743	38.2
4 ,, ,,	18 19	178 31.2	785	38.0
8 ,, ,,	18 18.8	178 45.6	955	38.2
8 ,, ,,	18 18.7	178 58.1	1147	36.8
8 ,, ,,	18 18.8	179 6	1210	36.8
9 ,, ,,	18 2.1	179 40.6	1337	36.9
9 ,, ,,	17 52	179 45	1437	36.8
9 ,, ,,	17 42.1	179 57	1415	37.1
9 ,, ,,	17 31.6	179 54.7 W.	1374	37.2
9 ,, ,,	17 21.2	179 46.3	863	38.2
9 ,, ,,	17 9.6	179 50.6	1047	37.9
9 ,, ,,	17 3.5	179 43.2	888	38.8
9 ,, ,,	16 54.5	179 32	779	37.2
10 ,, ,,	16 48	179 20.9	694	37.0
10 ,, ,,	16 12.3	177 35.1	1352	36.5
11 ,, ,,	15 59.6	177 44.6	1301	36.7
11 ,, ,,	15 55.3	177 35.7	1432	37.0
11 ,, ,,	15 46.7	177 19.4	1330	36.4
11 ,, ,,	15 54	177 17.2	1298	36.5
11 ,, ,,	15 57.7	177 8.7	770	37.4
11 ,, ,,	16 7.6	177 13.5	868	37.0
11 ,, ,,	16 17.5	177 14.9	1276	36.3
16 ,, ,,	15 31.2	175 52.3	1158	36.6
17 ,, ,,	15 27.7	175 47.8	669	37.0
17 ,, ,,	15 29.6	175 31	1138	36.6
20 ,, ,,	14 12.2	172 11.1	2128	34.4
20 ,, ,,	14 4.1	171 49.5	1027	36.7
20 ,, ,,	14 49.4	171 51.9	2532	34.1
20 ,, ,,	15 7.9	172 18.7	3112	34.8
21 ,, ,,	15 32.5	172 3.5	3532	34.3
21 ,, ,,	15 52.9	172 36.8	2427	34.2
22 ,, ,,	16 28.8	173 1.4	1611	35.5
22 ,, ,,	17 2.9	173 35.4	600	39.0
23 ,, ,,	17 26.2	173 24.7	816	37.2
23 ,, ,,	17 47.4	173 32.9	740	37.4
23 ,, ,,	18 22.7	173 50.3	1141	36.3
23 ,, ,,	18 27.6	173 59.3	1134	36.4
26 ,, ,,	19 43.5	175 9.1	800	37.8
26 ,, ,,	19 51.5	175 12.6	839	37.9
26 ,, ,,	20 0	175 15.4	1027	37.5
26 ,, ,,	20 9.3	175 20.7	1123	36.8
27 Decr. ,,	24 5.8	174 17.4	3185	35.0
28 ,, ,,	26 43.2	175 13.7	3350	37.0
1 Jan., 1896	31 15.3	177 18.4	3715	35.0
16 July ,,	8 35.4	179 17.5 E.	2298	37.0
16 ,, ,,	8 34.3	179 16.2	1768	39.6
16 ,, ,,	8 33.3	179 14.9	1348	39.0
27 Nov. ,,	27 24	177 5	2295	37.0
28 ,, ,,	28 55	176 15.5	2360	37.8
16 Decr. ,,	41 4	156 15 7	2470	34.8
13 April, 1897	30 56.3	160 20.7	740	38.3
14 ,, ,,	29 31.4	163 51.3	1030	40.3
18 ,, ,,	24 3.5	171 24.6	2380	34.5
19 ,, ,,	22 50.4	172 38	1847	35.0
19 ,, ,,	22 23.7	173 6.1	799	37.5
20 ,, ,,	21 14	174 37.6	1844	35.3
29 ,, ,,	16 57.7	179 27 W.	820	37.5
29 ,, ,,	16 49.7	179 18.7	753	38.2
30 ,, ,,	16 18.5	179 3	432	42.0

PENGUIN—

Date.	Latitude	Longitude.	Depth.	Temp. F.
	° ′	° ′	fms.	°
30 April. 1897	16 28.2	179 9.5	427	42.4
30 ,, ,,	16 33.2	179 12.5	632	39.0
30 ,, ,,	16 40.5	179 19.5	588	39.5
1 May ,,	15 58.5	178 44.2	1494	35.3
1 ,, ,,	15 48	178 37.7	1165	36.5
1 ,, ,,	15 37.5	178 31.2	994	36.7
2 ,, ,,	14 28.7	177 46.5	1411	35.3
2 ,, ,,	14 18.2	177 40.5	1077	36.7
2 ,, ,,	14 9.7	177 35.5	798	37.7
2 ,, ,,	14 5	177 33.5	1022	37.0
3 ,, ,,	13 6.2	176 49.2	2140	35.3
3 ,, ,,	12 49.7	176 41.7	1123	36.0
3 ,, ,,	12 45	176 36.7	1382	35.5
3 ,, ,,	11 9.7	175 36.5	1992	34.4
5 ,, ,,	9 55	174 46.5	2293	34.3
5 ,, ,,	9 41	174 37.5	2290	34.3
12 ,, ,,	3 49.1	170 35.2	1630	35.0
12 ,, ,,	3 53.5	170 37.7	2391	35.0
13 ,, ,,	2 53	169 49.8	2783	34.8
13 ,, ,,	1 48	168 38.7	2983	34.8
7 Sept. ,,	0 3.5	163 2.7	2879	35.0
7 ,, ,,	0 22.7	163 20.2	2945	35.0
8 ,, ,,	1 36	164 16.3	2941	35.0
9 ,, ,,	1 56.5	164 42.3	2905	34.8
9 ,, ,,	3 10	165 47.3	2212	35.7
9 ,, ,,	3 27	166 3.4	2498	35.0
10 ,, ,,	4 29.2	167 1.2	3101	35.0
12 ,, ,,	7 6.4	169 31	3131	35.5
12 ,, ,,	7 26	169 51	2852	35.3
13 ,, ,,	8 37.5	170 58.8	2420	36.3
14 ,, ,,	9 16.3	171 35.7	2051	37.0
14 ,, ,,	9 22	171 48.7	1790	37.0
14 ,, ,,	9 32	171 58.9	2023	37.3
14 ,, ,,	9 47.4	172 11.2	2186	37.2
15 ,, ,,	10 34	172 53	1810	37.5
15 ,, ,,	10 41.9	173 3.1	2565	37.0
15 ,, ,,	10 57.3	173 24.3	2583	36.1
16 ,, ,,	11 19	173 40.3	2560	36.5
19 ,, ,,	12 51.8	175 23.8	1501	37.0
19 ,, ,,	12 59.2	175 30.8	2010	37.0
20 ,, ,,	13 10.3	175 41.3	2225	36.6
20 ,, ,,	13 21.4	175 51.7	1898	37.0
20 ,, ,,	13 42.4	176 10.4	1939	36.9
20 ,, ,,	13 52.2	176 19.2	1264	37.9
20 ,, ,,	14 0	176 26.3	785	39.5
20 ,, ,,	14 2.2	176 28.3	1100	38.3
20 ,, ,,	14 8.3	176 34	1005	39.0
20 ,, ,,	14 13.7	176 39.2	1116	39.1
21 ,, ,,	14 20.1	176 46	1126	39.1
21 ,, ,,	14 24	176 59.9	1174	39.0
21 ,, ,,	14 30	177 2.5	1068	38.0
21 ,, ,,	14 35.7	177 6.9	894	39.2
21 Nov. ,,	21 47 3	179 25.6 E.	2043	37.8
21 ,, ,,	22 26.3	179 22.0	1988	37.8
22 ,, ,,	22 49.0	179 20.0	1948	37.9
22 ,, ,,	24 29.4	179 2.1	2018	35.5
23 ,, ,,	25 6.2	178 55.4	1983	35.5
23 ,, ,,	25 42.7	178 47.6	2183	35.6
23 ,, ,,	26 9.8	178 41.9	2290	35.6
24 ,, ,,	26 57.8	178 35.9	2318	35.6
24 ,, ,,	27 45.5	178 29.5	1803	35.6
24 ,, ,,	28 35.0	178 22.5	2080	35.6

PENGUIN—

Date.	Latitude.	Longitude.	Depth.	Temp. F.
	° ′	° ′	fms.	°
25 Nov. 1897	29 59.5	177 37.0	2143	35.8
26 ,, ,,	31 39.2	176 49.6	2210	35.8
26 ,, ,,	32 23.5	176 29.2	2116	35.8
26 ,, ,,	33 0.7	176 16.0	2036	35.7
27 ,, ,,	33 56.3	175 54.4	1463	35.4
4 Dec. ,,	35 10.2	171 4 .5	1072	37.0
4 ,, ,,	35 17.3	170 49.0	1127	37.0
4 ,, ,,	35 23.6	170 34.5	994	37.8
5 ,, ,,	36 9.1	169 20 1	1298	36.8
7 ,, ,,	38 24.0	163 15.0	2182	35.1
16 April, 1898	33 50.8	158 47.7	2338	35.0
17 ,, ,,	33 57.4	161 37.8	933	38.0
29 ,, ,,	36 3.4	178 55.4	1389	36.2
2 May ,,	32 16.6	175 54.7 W.	3220	36.9
3 ,, ,,	31 28.0	175 5.7	3100	35.3
5 ,, ,,	29 17.8	175 11.7	3105	35.1
6 ,, ,,	27 28.5	174 31.9	2630	34.4
6 ,, ,,	26 38.5	174 178	2420	34.1
7 ,, ,,	25 53.4	174 6.2	2775	34.2
8 ,, ,,	23 24.0	173 40.3	3205	34.5
8 ,, ,,	22 14.0	173 29.3	3420	34.3
8 ,, ,,	21 36.0	173 43.4	4762	34.5
8 ,, ,,	21 8.3	174 7.6	2115	34.9
11 Decr. ,,	22 40.1	179 57.6 E.	1238	35.8
13 ,, ,,	23 52.0	175 8.8	2430	36.0
13 ,, ,,	24 25.0	174 39.8	2483	35.9
14 ,, ,,	25 30.6	173 32.3	2380	35.9
14 ,, ,,	26 1.8	172 56.5	2428	35.9
15 ,, ,,	27 19.5	171 58.2	2328	35.8
15 ,, ,,	27 55.5	171 22.5	1632	35.9
16 ,, ,,	29 27.5	169 12.7	1200	36.6
16 ,, ,,	29 35.3	168 51.6	1269	34.2
17 ,, ,,	30 29.3	166 16.6	1819	36.0
18 ,, ,,	30 45.5	165 34.7	1768	36.0
18 ,, ,,	30 57.0	164 52.7	1557	36.2
18 ,, ,,	31 2.6	164 33.7	1196	36.8
18 ,, ,,	31 10.3	164 12.7	1173	36.8
20 ,, ,,	33 6.7	158 32.6	1430	35.8
21 ,, ,,	33 7.0	157 9.6	2210	34.6
21 ,, ,,	33 17.0	156 46.4	2677	34.8
21 ,, ,,	33 23.0	156 9.6	815	38.1
7 April, 1902	32 28.0	168 46.5	1043	37.0
8 ,, ,,	31 58.5	168 24.5	1187	36.4
8 ,, ,,	32 8.5	168 3.5	363	50.4
8 ,, ,,	32 13.0	167 47.5	906	39.2
8 ,, ,,	32 25.0	167 25.2	297	50.0
8 ,, ,,	32 29.7	166 11.5	947	37.5
9 ,, ,,	32 30.0	165 56.0	1381	36.2
9 ,, ,,	32 31.5	165 31.5	1800	34.6
9 ,, ,,	32 52.7	164 37.0	1725	36.2
10 ,, ,,	33 8.0	163 59.5	1092	37.4
10 ,, ,,	33 14.5	163 36.5	566	41.0
10 ,, ,,	33 14.5	163 36.5	566	41.0
10 ,, ,	32 52.0	162 52.0	473	44.8
10 ,, ,,	32 34.5	162 26.5	508	42.8
11 ,, ,,	32 18.5	162 1.0	573	42.6
11 ,, ,,	31 11.0	160 30.0	768	40.0
11 ,, ,,	31 2.0	160 14.0	842	38.6
12 ,, ,,	30 45.2	159 43.2	992	36.3
12 ,, ,,	30 44 5	159 29.1	1215	36.2
13 ,, ,,	31 13.0	155 19.5	2468	34.2

WATERWITCH—

Date.	Latitude	Longitude.	Depth.	Temp
	° ′	° ′	fms.	°
10 May, 1895	35 11.5	165 47.2	830	39.3
12 ,, ,,	34 11	173 39.2	1095	36.3
12 ,, ,,	33 41.5	173 48.2	1020	37.1
13 ,, ,,	33 10.3	173 58.7	1724	36.9
13 ,, ,,	32 51	173 49.8	1320	35.8
13 ,, ,,	32 36.2	173 41.5	1310	36.3
13 ,, ,,	32 20	174 14	1980	35.7
14 ,, ,,	31 35.3	174 25	2110	35.8
14 ,, ,,	31 30.5	174 13	2020	35.7
14 ,, ,,	31 29	173 45	1745	35.6
16 ,, ,,	28 30.8	175 9.3	2410	35.4
16 ,, ,,	28 19.3	174 52.3	2280	35.6
16 ,, ,,	28 19.5	175 13.2	1260	36.2
16 ,, ,,	28 5	175 17	2270	36.3
18 ,, ,,	25 0.3	175 55	2505	35.6
18 ,, ,,	23 9.2	176 27.3	2390	35.4
19 ,, ,,	22 11.7	176 52.7	2270	35.4
19 ,, ,,	20 31.3	177 19.4	1200	36.2
19 ,, ,,	20 31.3	177 19.4	1175	36.2
20 ,, ,,	19 45.5	177 35.7	1220	36.1
20 ,, ,,	19 8.2	177 56	280	55.1
20 ,, ,,	18 48.6	178 0.5	1180	35.9
21 ,, ,,	18 27.2	178 27	1130	36.1
17 Sept. ,,	18 44.9	179 54.8	511	41.0
17 ,, ,,	18 49.5	179 52.7	1625	35.3
17 ,, ,,	18 59.7	179 50.3	1710	35.3
17 ,, ,,	19 3.7	179 50.5	1435	35.3
17 ,, ,,	19 3	179 55.5	1600	35.3
19 ,, ,,	14 57	179 1.5 W.	1175	36.2
19 ,, ,,	14 20.2	178 37.7	1250	36.3
20 ,, ,,	13 3.7	177 41	1648	35.2
21 ,, ,,	11 9.6	176 13.3	1873	35.1
22 ,, ,,	12 17	176 20	1420	35.4
22 ,, ,,	12 30	176 31	1635	35.6
22 ,, ,,	12 43.5	176 52.5	1378	35.6
25 ,, ,,	11 14.7	176 46.3	1535	35.2
25 ,, ,,	11 29	176 55	1965	34.9
30 ,, ,,	14 52.5	179 32.5	1395	35.6
30 ,, ,,	15 10	179 42.8	1305	36.1
30 ,, ,,	15 24.3	179 46.5	1472	35.5
30 ,, ,,	15 35	179 47.8	1675	35.5
30 ,, ,,	15 47.5	179 41.5	293	51.0
4 Decr. ,,	20 50.3	175 42.5 E.	1766	36.4
5 ,, ,,	21 32.5	174 55.7	1400	36.5
5 ,, ,,	22 41.2	173 44	1560	36.8
7 ,, ,,	25 3.2	171 37.8	2312	35.4
7 ,, ,,	25 27	170 17.2	2033	35.3
8 ,, ,,	27 13	169 42.7	2132	35.3
9 ,, ,,	29 0.2	166 50	1950	35.5
10 ,, ,,	29 4	165 37.5	1795	35.5
11 ,, ,,	29 3	163 11.7	820	38.5
11 ,, ,,	29 3.5	162 24.2	710	40.1
11 ,, ,,	28 58.2	160 48	875	38.3
12 ,, ,,	28 52	159 57	1575	35.0
13 ,, ,,	28 53.2	158 6	1612	35.3
13 ,, ,,	28 43	155 55.5	2379	33.8
14 ,, ,,	28 35.2	154 49.5	2565	34.0
17 May, 1896	33 44	152 49	2660	33.8
18 ,, ,,	33 3.5	155 11	2903	33.9
18 ,, ,,	32 50	157 5	2020	34.4
19 ,, ,,	32 25.7	158 22.5	2300	34.3

WATERWITCH—

Date.	Latitude.	Longitude.	Depth.	Temp. F.
	° ′	° ′	fms,	°
19 May, 1896	32 20.5	158 56.7	2325	34.3
20 ,, ,,	31 41·5	161 11	748	38.6
20 ,, ,,	31 18.4	162 38.2	630	40.8
21 ,, ,,	30 56	163 20.2	805	40.8
21 ,, ,,	30 38.2	164 3.7	1125	36.8
22 ,, ,,	29 50.2	165 52	1410	35.8
22 ,, ,,	29 13.7	167 34	1265	36.1
23 ,, ,,	28 34.7	167 50.7	455	47.0
23 ,, ,,	27 7.2	168 36.7	1750	34.5
25 ,, ,,	26 21.2	168 54.2	1665	35.8
26 ,, ,,	25 29.7	169 13.8	1380	35.9
27 ,, ,,	23 18.5	170 38.7	2310	35.4
3 June ,,	23 18.2	170 6.7	1865	34.9
3 ,, ,,	23 14.1	170 6.2	1200	35.7
3 ,, ,,	23 12.9	170 6.2	1290	35.5
3 ,, ,,	23 14.2	170 5	1360	35.5
3 ,, ,,	23 16	169 46.5	1808	35.1
3 ,, ,,	23 8.2	169 46.6	1808	35.1
3 ,, ,,	23 10.7	169 39.2	1370	35.3
12 ,, ,,	23 15.8	169 26 9	900	36.8
12 ,, ,,	23 11.7	169 28.2	550	40.5
15 ,, ,,	22 12.4	171 7.9	1416	35.3
15 ,, ,,	22 17	171 7.9	1008	36.5
15 ,, ,,	22 12	171 14.6	1252	35.3
15 ,, ,,	22 14.5	171 18.8	946	36.5
16 ,, ,,	22 3.2	171 17	1470	35.3
16 ,, ,,	21 56.5	171 15	1602	35.3
16 ,, ,,	21 49.7	171 12.2	1470	35.5
16 ,, ,,	21 42.5	171 9.5	1510	35.3
16 ,, ,,	21 36	171 5.7	1280	35.7
16 ,, ,,	21 29.2	171 2.1	1370	35.5
16 ,, ,,	21 22.5	170 58.2	1245	35.7
16 ,, ,,	21 19.5	171 1.2	1462	35.3
16 ,, ,,	21 24.2	171 9.6	1342	35.6
17 ,, ,,	21 25.9	170 55.7	1245	35.6
17 ,, ,,	21 25.9	170 52.4	1210	35.6
17 ,, ,,	21 26.1	170 47.8	1420	35.7
17 ,, ,,	21 26.3	170 43.2	1280	35.5
17 ,, ,,	21 26.6	170 38.7	1150	35.9
17 ,, ,,	21 21.6	170 38.7	1249	35.9
17 ,, ,,	21 20.2	170 43.8	1170	36.0
17 ,, ,,	21 19	170 49.4	1315	35.9
17 ,, ,,	21 17.5	170 54.9	842	37.0
17 ,, ,,	21 19.1	170 56.4	940	36.5
18 ,, ,,	21 22	170 53.1	719	38.6
18 ,, ,,	21 16.2	170 52.5	1535	35.4
18 ,, ,,	21 19.2	170 51.6	1340	35.8
18 ,, ,,	21 22.1	170 50.8	1280	35.7
18 ,, ,,	21 23.1	170 53.3	1295	35.7
18 ,, ,,	21 22.2	170 56	1112	35.8
18 ,, ,,	21 20.1	170 56.7	1090	35.9
18 ,, ,,	21 20.8	170 54.8	601	40.2
18 ,, ,,	21 21.3	170 54.5	717	38.2
18 ,, ,,	21 19.9	170 55.2	676	38.6
18 ,, ,,	21 20.8	170 55.3	745	38.4
18 ,, ,,	21 28	170 50.1	1450	35.6
18 ,, ,,	21 31.7	170 47.4	1372	35.6
19 ,, ,,	21 32.3	170 54	1090	35.9
19 ,, ,,	21 35.3	170 55.9	1195	35.8
19 ,, ,,	21 41.9	170 59.2	1415	35.4
19 ,, ,,	21 48.5	171 2.4	1410	35.6
19 ,, ,,	21 54.5	171 5.9	1551	35.5

WATERWITCH—

Date.	Latitude.	Longitude.	Depth.	Temp. F.
	° ′	° ′	fms.	°
19 June, 1896	22 0.7	171 8.7	1437	35.6
19 ,, ,,	22 6.5	171 11.9	1420	35.6
20 ,, ,,	22 17.7	171 21.9	616	39.8
20 ,, ,,	22 19.2	171 21.9	456	40.2
21 ,, ,,	22 3.7	172 35.7	1815	35.5
21 ,, ,,	21 52.7	173 40.5	1410	36.0
22 ,, ,,	21 31.2	174 13.4	1770	35.9
4 Novr., ,,	15 53.9	176 45.3	910	37.8
4 ,, ,,	15 53	176 44.8	610	39.8
4 ,, ,,	15 52.2	176 45.5	722	38.8
4 ,, ,,	15 53	176 43.7	750	38.6
4 ,, ,,	15 46.1	176 35.8	1680	36.2
4 ,, ,,	15 46.4	176 32	1580	36.2
4 ,, ,,	15 46.6	176 27.8	1532	36.8
4 ,, ,,	15 44.9	176 27.2	1635	35.3
4 ,, ,,	15 43.2	176 27.3	1740	36.0
4 ,, ,,	15 43.4	176 31.6	1623	36.0
4 ,, ,,	15 43.7	176 36.1	1620	36.4
4 ,, ,,	15 43.9	176 40.3	1683	36.3
4 ,, ,,	15 40.7	176 36.0	1325	36.4
5 ,, ,,	15 40.7	176 32	1624	36.0
5 ,, ,,	15 41.8	176 28.4	1758	36.0
5 ,, ,,	15 39.9	176 28.5	1734	36.3
5 ,, ,,	15 39.9	176 24.4	1715	36.1
5 ,, ,,	15 39.9	176 20.4	1730	36.0
5 ,, ,,	15 39.9	176 16.5	1738	35.9
5 ,, ,,	15 44.1	176 16.8	1800	36.0
5 ,, ,,	15 44.3	176 21.2	1740	36.0
6 ,, ,,	15 44.2	176 12.8	1815	35.9
6 ,, ,,	15 44.5	176 7.9	1590	35.9
6 ,, ,,	15 44.7	176 3.1	1500	36.0
6 ,, ,,	15 44.6	175 58.1	1524	36.0
6 ,, ,,	15 44.6	175 53.3	1030	36.8
6 ,, ,,	15 42.2	175 53.6	633	39.1
6 ,, ,,	15 42.2	175 52.7	417	43.6
8 ,, ,,	15 48.8	175 42	958	37.7
8 ,, ,,	15 42.5	175 37.4	1785	36.2
8 ,, ,,	15 42.7	175 31.6	1780	36.0
8 ,, ,,	15 42.8	175 25.9	1720	35.8
8 ,, ,,	15 42.7	175 20.3	1575	36.0
8 ,, ,,	15 42.9	175 14.7	1732	36.1
8 ,, ,,	15 38.2	175 14.2	1570	36.1
8 ,, ,,	15 38.3	175 19.4	1695	36.2
9 ,, ,,	15 42.7	175 21.2	1555	36.1
9 ,, ,,	15 41.8	175 17.7	1658	36.0
9 ,, ,,	15 30	175 18.2	1673	36.0
9 ,, ,,	15 30.2	175 13.1	1540	36.1
9 ,, ,,	15 30	175 8.1	1657	36.0
9 ,, ,,	15 25.7	175 8.5	1555	36.1
10 ,, ,,	15 27.3	175 27.2	1650	36.0
10 ,, ,,	15 33.3	175 27.7	1710	35.9
10 ,, ,,	15 33.8	175 17.6	1757	35.7
10 ,, ,,	15 33.9	175 10.5	1687	35.6
10 ,, ,,	15 33.9	175 3.9	1600	36.0
10 ,, ,,	15 33	174 56.7	1475	35.6
10 ,, ,,	15 33	174 49.5	1655	35.8
10 ,, ,,	15 26.9	174 50.4	1580	35.3
10 ,, ,,	15 26.2	174 59.5	1705	35.5
10 ,, ,,	15 31	174 58.3	1522	35.8
11 ,, ,,	15 34.6	174 56.2	1672	35.6
11 ,, ,,	15 39	174 50.9	1724	35.8
11 ,, ,,	15 38.7	174 59.7	1710	35.7

Waterwitch—

Date.	Latitude	Longitude	Depth. fms.	Temp. F. °
	° ′	° ′		
11 Nov. 1896	15 39.6	175 7.8	1485	35.8
11 " "	15 42.3	175 6	1662	35.6
11 " "	15 47.6	175 10.2	1773	35.8
11 " "	15 49.1	175 17.3	1660	36.2
12 " "	15 37	175 32.1	1758	35.7
12 " "	15 35.7	175 43	1710	35.8
12 " "	15 30.5	175 56.8	1475	35.8
13 " "	15 39.5	176 38.3	1395	36·2
13 " "	15 39.2	176 36.9	1480	35.7
13 " "	15 41.8	176 44.8	1715	35.6
13 " "	15 46.2	176 45	1390	35.6
26 " "	23 16	170 10.8	1830	35.2
27 " "	23 1.25	170 5.1	1455	35.5
27 " "	23 13	170 4.2	1490	35.5
28 " "	23 52.8	169 21.3	1105	36.2
28 " "	24 47.9	168 44.4	1290	36.5
28 " "	25 41.2	168 15.2	1210	36.0
29 " "	26 28.7	167 48	758	38.7
29 " "	26 55.5	167 32.2	410	47.7
29 " "	27 16.3	167 20.6	458	43.3
29 " "	27 39.7	167 6.7	1492	36.2
29 " "	28 15.8	166 44	1900	35.8
30 " "	29 33.7	165 17.5	1855	35.5
30 " "	29 42.7	163 15.5	759	38.7
1 Decr. "	29 46.1	162 27.2	650	41.5
1 " "	29 44.5	160 26.7	1000	36.9
2 " "	29 43.7	159 50.9	1300	35.6
2 " "	29 40.7	159 5.8	1558	35.0
2 " "	29 56.2	157 24.1	1780	34.3
3 " "	29 59	156 29.6	2725	34.1
3 " "	30 35	154 34.1	2672	34.2
4 " "	30 51.5	153 52.3	2170	34.0
U.S.S. Albatross—				
22 Nov., 1899	18 54	162 31 W.	2498	34.7
28 " "	18 59	164 47	2882	33.4
24 " "	19 4	167 41	2472	33.9
26 " "	20 15	172 0	3141	34.0
27 " "	21 18	173 51	4540	34.15
6 Dec. "	18 43	175 28	1381	36.2
7 " "	18 50	178 28	453	42.9
7 " "	18 54	178 35	324	47.0
7 " "	18 56	178 43	600	39.3
7 " "	18 56	178 50	450	42.4
9 " "	18 56.5	179 16	990	37.0
21 " "	12 43	179 50	1445	35.6
S. S. Britannia—				
18 May, 1901	27 58 10	153 27 40 E.	10	69.0
18 " "	27 58 12	153 30 20	25	69.2
18 " "	28 0 10	153 50 30	75	62.9
18 " "	28 2 2	153 58 6	223	53.4
18 " "	28 2 15	154 5 6	530	42.5
18 " "	28 7 34	154 11 36	910	37.9
19 " "	28 6 22	154 18 30	1092	36.9
19 " "	28 11 58	154 25 10	1446	36.2
19 " "	28 17 30	154 46 45	2197	35.0
19 " "	28 0 35	154 50 12	2645	35.3
19 " "	28 8 15	155 34 15	824	38.8
31 " "	28 1 29	155 37 0	220	58.2
31 " "	27 51 0	155 54 30	2676	34.4
31 " "	27 47 54	155 23 52	1738	35.5
2 June "	28 42 0	155 20 0	2450	34.4
2 " "	28 30 30	155 13 45	2496	34.4

S. S. Britannia.

Date.	Latitude.	Longitude.	Depth. fms.	Temp. F. °
	° ′ ″	° ′ ″		
3 June, 1901	28 52 0	155 48 45	2430	34.4
3 " "	28 49 30	156 21 0	2785	34.5
4 " "	28 52 30	157 8 30	2566	34.5
5 " "	28 59 39	157 46 18	1552	34.7
5 " "	29 1 45	158 25 30	1389	35.7
5 " "	28 56 0	159 11 0	1597	35.1
7 " "	28 53 0	160 14 0	1290	36.8
7 " "	29 1 41	160 32 54	908	38.6
7 " "	28 51 0	160 54 0	850	38.8
8 " "	28 54 16	161 48 9	840	38.6
8 " "	28 50 4	162 23 21	726	39.3
8 " "	29 2 30	162 44 0	750	39.9
8 " "	29 0 20	163 1 16	843	38.6
9 " "	28 59 30	163 23 30	974	37.7
9 " "	29 2 40	163 44 1	1072	37.2
9 " "	28 53 24	164 13 15	1638	36.5
9 " "	29 9 42	164 24 28	1875	36.4
9 " "	28 58 39	164 48 12	1879	36.4
10 " "	29 2 0	165 23 0	1407	36.5
10 " "	29 4 30	166 1 30	1830	36.3
11 " "	29 9 45	166 32 6	1840	36.2
11 " "	29 3 30	167 1 0	1760	36.4
11 " "	29 4 38	167 24 20	1220	36.6
11 " "	29 5 35	167 32 0	1210	36.8
11 " "	29 5 17	167 37 20	1132	37.0
14 " "	29 0 25	167 18 50	1143	37.0
14 " "	29 0 15	167 28 10	1143	36.9
14 " "	28 58 52	167 40 0	600	42.1
14 " "	29 0 30	167 42 15	664	41.2
15 " "	28 59 17	167 45 20	328	50.4
15 " "	29 0 37	167 47 5	225	56.6
15 " "	29 0 50	167 48 12	49	62.8
15 " "	29 0 40	167 47 40	125	62.0
15 " "	29 1 19	167 49 10	30	61.1
15 " "	29 1 12	167 55 0	19	63.5
15 " "	28 58 25	167 47 22	175	58.7
16 " "	28 57 0	167 41 0	372	47.7
16 " "	28 57 46	167 40 20	450	46.4
16 " "	28 53 50	167 37 18	596	42.3
16 " "	28 54 40	167 54 30	26	66.0
16 " "	28 48 20	168 1 50	29	63.9
16 " "	28 42 43	168 6 24	356	48.0
18 " "	29 10 0	167 53 0	40	67.3
18 " "	29 12 17	167 56 20	32	68.0
18 " "	29 15 2	167 59 51	36	68.1
18 " "	29 17 18	168 4 2	32	67.6
18 " "	29 20 48	168 9 30	103	67.3
21 " "	29 20 58	168 10 10	116	62.5
21 " "	29 20 25	168 9 10	85	61.1
21 " "	29 18 57	168 6 29	42	63.8
21 " "	29 21 48	168 12 15	200	58.2
21 " "	29 25 7	168 15 11	305	49.6
21 " "	29 26 35	168 22 1	550	42.5
22 " "	29 33 45	168 27 19	814	38.9
22 " "	29 40 32	168 41 40	720	39.4
23 " "	29 41 30	168 41 0	855	38.3
23 " "	29 38 30	168 29 24	856	38.3
23 " "	29 41 52	168 33 11	1360	36.4
24 " "	29 48 17	168 39 31	1583	36.3
24 " "	30 4 0	169 0 0	1584	36.3
24 " "	30 12 0	169 7 0	1628	36.3
24 " "	30 25 32	169 22 0	1828	36.3

WATERWITCH—

Date.	Latitude ° ′ ″	Longitude. ° ′ ″	Depth. fms.	Temp. F. °
25 June, 1901	31 19 30	170 20 0	2438	36.4
25 ,, ,,	31 31 47	170 32 5	2236	36.5
25 ,, ,,	31 46 17	170 47 53	1754	36.5
25 ,, ,,	32 12 0	171 3 15	1745	36.4
25 ,, ,,	32 9 15	171 19 30	1853	36.5
25 ,, ,,	32 14 30	171 32 0	1893	36.4
25 ,, ,,	32 23 52	171 25 54	1840	36.4
25 ,, ,,	32 39 19	171 55 35	1220	36.4
27 ,, ,,	33 7 0	172 28 30	1063	36.4
27 ,, ,,	32 53 32	171 55 4	1250	36.2
28 ,, ,,	33 41 53	173 1 25	1095	36.2
28 ,, ,,	33 50 58	173 22 30	1116	36.4
28 ,, ,,	34 3 26	173 24 25	1112	36.2
28 ,, ,,	34 16 47	173 25 22	900	37.7
4 July ,,	34 55 10	173 29 40	23	49.8
4 ,, ,,	35 0 23	173 48 25	13	48.4
4 ,, ,,	34 58 45	173 49 50	25	51.4
6 ,, ,,	34 51 30	173 34 25	64	51.2
6 ,, ,,	34 44 0	173 34 50	104	51.9
13 ,, ,,	34 31 42	173 34 30	168	53.1
13 ,, ,,	34 29 30	173 36 57	465	44.5
16 ,, ,,	29 21 38	168 9 51	147	60.9
16 ,, ,,	29 20 0	168 7 20	42	61.0
17 ,, ,,	28 47 35	168 2 12	33	65.9
17 ,, ,,	28 47 8	168 2 33	35	65.9
17 ,, ,,	28 46 50	168 2 44	42	64.7
17 ,, ,,	28 45 50	168 4 30	210	54,7
17 ,, ,,	28 44 30	168 6 0	314	48.7.
17 ,, ,,	28 38 15	168 12 30	1340	36.5
17 ,, ,,	28 39 16	168 11 6	1210	36.8
17 ,, ,,	28 25 59	168 29 40	1810	36.3
18 ,, ,,	27 8 48	169 55 39	842	38.8
19 ,, ,,	26 58 20	170 22 45	2150	36.5
20 ,, ,,	26 18 29	171 6 10	1888	36.3
20 ,, ,,	26 5 10	171 36 3	2180	35.7
20 ,, ,,	25 42 2	171 39 59	2332	35.9
21 ,, ,,	25 19 31	172 9 48	1922	35.9
21 ,, ,,	25 5 15	172 36 0	2408	35.9
22 ,, ,,	24 11 0	173 6 0	2280	35.8
22 ,, ,,	23 41 30	173 41 15	2048	35.8
23 ,, ,,	23 12 35	174 45 9	2350	35.8
23 ,, ,,	22 42 46	174 48 36	2439	35.6
24 ,, ,,	22 1 30	175 15 0	1756	35.7
24 ,, ,,	21 38 30	175 41 0	1245	36.3
25 ,, ,,	22 21 18	175 45 30	2158	35.8

WATERWITCH—

Date.	Latitude ° ′ ″	Longtiude. ° ′ ″	Depth. fms.	Temp. F. °
25 July, 1901	22 2 1	175 50 32	2144	35.8
26 ,, ,,	21 46 36	175 54 40	2077	35.9
26 ,, ,,	21 34 6	176 20 0	1608	35.9
26 ,, ,,	21 33 30	176 6 0	1031	36.6
27 ,, ,,	20 32 51	176 43 49	1839	36.0
28 ,, ,,	19 2 0	177 34 45	1491	36.0
28 ,, ,,	18 55 0	177 47 30	1194	36.2
28 ,, ,,	18 36 0	178 18 0	1161	36.3
28 ,, ,,	18 26 0	178 19 30	1132	36.4
28 ,, ,,	18 21 30	178 20 0	1000	36.9
28 ,, ,,	18 16 30	178 21 20	795	37.8
29 ,, ,,	18 13 50	178 21 40	565	39.3
29 ,, ,,	18 12 10	178 22 0	275	49.2
29 ,, ,,	18 11 27	178 22 52	398	43.5
30 ,, ,,	18 11 14	178 23 50	196	61.3
30 ,, ,,	18 10 35	178 23 49	159	66.1
30 ,, ,,	18 9 58	178 23 54	144	67.5
4 Aug. ,,	17 23 45	179 44 45	1237	36.2
4 ,, ,,	17 17 45	179 53 40	1180	36.0
3 ,, ,,	16 57 30	179 38 0 W.	801	37.6
3 ,, ,,	16 49 50	179 27 15	375	44.1
4 ,, ,,	16 35 0	178 43 30	425	41.9
4 ,, ,,	16 25 30	178 35 0	930	37.0
4 ,, ,,	16 15 14	178 23 19	1514	36.1
6 ,, ,,	14 50 30	176 1 0	1166	36.7
6 ,, ,,	14 30 18	175 35 36	720	38.2
7 ,, ,,	14 28 30	175 17 40	2565	34.2
7 ,, ,,	13 53 0	174 46 0	1490	36.0
8 ,, ,,	13 43 45	174 16 15	2555	34.4
9 ,, ,,	13 22 0	173 54 0	2568	34.1
9 ,, ,,	13 8 3	173 46 4	2495	34.1
10 ,, ,,	12 33 17	173 5 41	2528	34.5
10 ,, ,,	11 58 30	172 33 30	2574	34.2
11 ,, ,,	11 18 41	171 52 53	2585	34.2
12 ,, ,,	10 5 0	170 59 0	2170	35.0
12 ,, ,,	9 24 37	170 21 0	2387	34.5
13 ,, ,,	8 20 34	169 31 34	2178	35.1
14 ,, ,,	7 1 30	168 27 45	2865	34.2
15 ,, ,,	5 44 30	167 34 0	3070	34.4
16 ,, ,,	4 11 30	166 15 0	3027	34.9
17 ,, ,,	3 36 3	165 44 29	2700	35.1
17 ,, ,,	3 20 6	165 52 15	2290	35.4
18 ,, ,,	2 18 0	164 45 30	2955	35.0
19 ,, ,,	0 42 30	163 19 15	2960	35.0

The total number of bottom temperatures recorded in the two preceding tables is thus 1,019; of these

22 are in depths under 100 fathoms,
57 ,, ,, between 100 ,, and 500 fathoms,
192 ,, ,, ,, 500 ,, ,, 1,000 ,,
269 ,, ,, ,, 1,000 ,, ,, 1,500 ,,
231 ,, ,, ,, 1,500 ,, ,, 2,000 ,,
248 ,, ,, over 2,000 ,,

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From these observations we have prepared the accompanying map (see Map III) showing the temperature at the bottom over the floor of the region, in which the scale of colouring is the same as

that used in the temperature sections. The two shades of red indicate temperatures over 50° F., the darker shade indicating a temperature over 60° F., while the three shades of blue indicate temperatures under 50° F., the palest shade indicating a temperature between 40° and 50° F., the second shade a temperature between 35° and 40°, and the darkest shade a temperature under 35° F. The warmer water, indicated by the red colour, is found only in close proximity to the land masses, and the palest shade of blue also occurs only near the land and on the shallow ridge between Australia and New Zealand, so that by far the larger portion of the map is occupied by the two deeper shades of blue, indicating a temperature at the bottom under 40° F., the darkest shade of blue, indicating a bottom temperature under 35° F., being limited to those parts of the region covered by very deep water.

The two small isolated areas coloured dark blue, the one to the north-east of the Louisiade archipelago, the other to the south-east of New Caledonia, in which temperatures under 35° F., have been recorded, seem rather peculiar, and may be due to errors of observation, but future observations may show that these two deep areas are connected in some way with the larger deep areas with a similar low temperature. In the north-eastern part of the map the area with temperatures under 35° is very peculiar in form, a line of soundings run by the " Penguin " from Wallis Island to the Union Group, and thence in a north-easterly direction, giving temperatures over 35° F., while two series running parallel to the Penguin line, the one taken by H.M.S. " Egeria " and the other by Mr. Peake in the s.s. " Britannia," gave bottom temperatures under 35° F.

From the observations of temperature at the bottom we have prepared the following table to show the range of temperature and the mean temperature at various depths :—

Depth.	No. of Observations.	Range of Temperature.	Mean Temperature.
		° °	°
0 to 100 fathoms	22	48.4 to 69.2 F.	62.39
100 ,, 500 ,,	53	40.2 ,, 67.3 ,,	52.03
500 ,, 1000 ,,	177	35.2 ,, 45.3 ,,	38.59
1000 ,, 1500 ,,	263	34.2 ,, 40.3 ,,	36.20
1500 ,, 2000 ,,	228	34.3 ,, 39.6 ,,	35.72
over 2000 ,,	246	31.8 ,, 37.8 ,,	35.05

The 22 observations at the bottom in depths under 100 fathoms were taken by Mr. Peake in the s.s. " Britannia " in the summer of 1901, off the coast of New South Wales, off Norfolk Island, and off the coast of New Zealand. The highest temperature was observed off the coast of New South Wales, while the lowest was recorded off the coast of New Zealand.

The 53 observations recorded on the bottom between 100 and 500 fathoms were taken in various parts of the region, the most northerly one being recorded off San Cristoval island in the Solomon group. The lowest temperature recorded (40.2°) was observed at 456 fathoms on a bank lying to the south-east of the New Hebrides, and is nearly 2° lower than any other reading at these depths. The highest reading (67.3°) was observed off Norfolk island in 103 fathoms, and a reading of 67.2° is recorded in 144 fathoms off the Fiji Islands.

The 177 observations of the temperature at the bottom in depths between 500 and 1,000 fathoms are widely scattered over the region under consideration, the most northerly observation having been taken between New Britain and New Ireland; a great many of the observations were taken in the seas around the Fijis and the Friendly Islands, on the shallow ridge between Australia and New Zealand, and in the Coral Sea. Off the coast of Australia, in latitude 39½° S., a reading of 34.3° is recorded, but as it was uncorrected we have omitted it from the Table. The next lowest reading was 35.2° observed on one of the banks about midway between the Fiji and Samoan Groups; this reading of 35.2° is one degree lower than any of the other readings at these depths. We have also omitted a reading of 51° (reported doubtful) at 946 fathoms on the shallow ridge lying between Australia and New Zealand, and a reading of 46.8° recorded at 972 fathoms on a bank about midway between New Zealand and the Fijis (also reported doubtful). The last mentioned is 1½° higher than the next highest reading, viz., 45.3° at 547 fathoms on the shallow ridge between Australia and New Zealand; this reading is again more than 2° higher than any other observation at these depths, the next highest reading being 43.1°, at 565 fathoms, farther to the north-east, on the shallow bank lying to the west of the north point of New Zealand.

The 263 observations taken at the bottom between 1,000 and 1,500 fathoms range from 34.2° to 40.3°, but the extreme observations, although not reported doubtful, differ considerably from the general run of the readings at these depths. Thus, the "Penguin" records an observation of 34.2° at 1,269 fathoms to the south-east of Norfolk Island, but the "Britannia" records 36.4° at similar depths in the same locality. The next lowest readings are two observations of 35.0° recorded by the "Penguin" at 1,140 and 1,437 fathoms in the Coral Sea, to the south of New Guinea; between them there is a record of 35.5° at 1,310 fathoms. Readings of 35.1° and 35.2° are recorded by the "Egeria" in the neighbourhood of the Fijis. The highest reading (40.3°) is recorded by the "Penguin" at 1,030 fathoms on the slope of the ridge between Norfolk Island and Middleton

Reef, but in shallower water on the ridge there is a record of 38.7° at 759 fathoms. The next highest readings are two observations of 39.1° recorded by the "Penguin" at 1,116 and 1,126 fathoms between Fiji and Wallis Island, but in the same locality we have records of 35.8° at 1,512 fathoms and 36.5° at 1,282 fathoms. The "Penguin" also records three observations of 39.0°, two at 1,005 and 1,174 fathoms, between Fiji and Wallis Island, and the third at 1,348 fathoms off Funafuti, Ellice group.

The 228 observations at the bottom in depths between 1,500 and 2,000 fathoms range from 34.3° to 39.6°; one of the observations is reported to be "doubtful" though the temperature appears to agree very well with that usually found at these depths. The reading of 39.6° recorded by the "Penguin" at 1,768 fathoms off Funafuti in the Ellice group is more than one and a half degrees higher than anything else recorded at these depths. The largest numbers of observations at one particular temperature are :—

		°			°
24	observations at	36.0	16	observations at	35.3
19	„ „	35.5	13	„ „	35.9
18	„ „	35.6	11	„ „	36.1
17	„ „	35.8	10	„ „	36.3

while of the 228 observations 193 (or 85 per cent.) show a temperature of 35.0° to 36.5°, which may therefore be regarded as the normal or usual temperature at these depths.

Let us consider the extreme observations (those below 35.0° and those above 36.5°) to see if there be any indications of warmer or colder areas at the bottom at these depths within the region under consideration. Of the 22 observations under 35.0°, there are seven at 34.9° in various parts of the region between lat. 11° and 23° S.,—three situated to the north-east of Fiji in depths of 1,910, 1,965, and 1,985 fathoms, one to the south of Fiji in 1,828 fathoms, one to the south-east of New Caledonia in 1,865 fathoms, and two in the southern part of the Coral Sea, one near the Balfour Shoal in 1,645 fathoms, the other farther south in 1,760 fathoms. There are three readings of 34.8° between latitude 17° and 21° S.,—one between the Friendly and Samoa Islands in 1,575 fathoms, the other two in the Coral Sea, one near the Balfour Shoal in 1,570 fathoms, the other farther south in 1,760 fathoms. There are three observations at 34.7°,—one in lat. 22½° S. in the Coral Sea, east of the Barrier Reef, in 1,810 fathoms, another farther south between Australia and Middleton Reef in 1,552 fathoms, and the third still farther south, between Cape Howe and New Zealand, in 1,975 fathoms. There are two readings of 34.6° in the Coral Sea, east of the Barrier Reef, in 1,745 and 1,800 fathoms. There are no fewer than five observations at 34.5°—two in the Coral

Sea, east of the Barrier Reef, in 1,552 and 1,740 fathoms, one much farther south (in lat. 29° S.), to the north of Middleton Reef, in 1,778 fathoms, one north of the Louisiade Archipelago, in 1,685 fathoms, and one to the north-west of the Kermadecs, in 1,750 fathoms. There is a reading of 34.4° north-east of Fiji in 1,992 fathoms, and finally there is one observation at the minimum temperature of 34.3° between Australia and Middleton Reef in 1,780 fathoms.

From the above it will be seen that these 22 lower readings (under 35.0°) are widely scattered over the region under consideration, but thirteen of them are situated in more or less close proximity to the deep basin lying between Australia and New Zealand, which would seem to indicate that the cold water at the bottom of this basin had a cooling influence on the surrounding shallower water.

Proceeding now to the higher readings (over 36.5°), we find the observations also scattered over the region. Of the 13 observations there is one at 36.7° to the south of the Fijis, lat. 19½° S., in 1,655 fathoms. There are two observations at 36.8°,—one east of New Caledonia, lat. 22½° S., in 1,560 fathoms, the other north-west of the Fijis, lat. 15¾° S., in 1,532 fathoms. There are two observations at 36.9°,—one to the north of New Zealand, lat. 33° S., in 1,724 fathoms, the other between Fiji and Wallis Island, lat. 13¾° S., in 1,939 fathoms. There are three readings of 37.0°,—one at 1,790 fathoms, lat. 9½° S., near Duke of Clarence Island, Union group, the other two farther to the south-west, near Lalla Rookh Bank, in 1,501 and 1,898 fathoms. There is one reading of 37.5° to the south-west of the Union group, lat. 10½° S., in 1,810 fathoms. There is one reading of 37.8° at 1,988 fathoms to the south of Fiji, lat. 22° S. There are two readings of 37.9° south of Fiji, lat. 21° and 22¾° S., in 1,948 and 1,969 fathoms. Finally, there is the extraordinarily high reading of 39.6° in 1,768 fathoms off Funafuti, previously mentioned. We have already referred to the high readings of 39.0° at the bottom in 1,348 fathoms off Funafuti, and there is also a reading of 37.0° at the bottom in 2,298 fathoms; these observations, if trustworthy, indicate the presence of very warm water at great depths among these coral islands.

The 246 observations in depths over 2,000 fathoms show a range of 6°: from 31.8° to 37.8°, the mean being 35.05°. The largest numbers of observations at one particular temperature are:—

24 readings at	34.5°	13 readings at	34.4°
21 „ „	35.0	12 „ „	34.2
16 „ „	35.8	12 „ „	34.0
15 „ „	35.5		

while of the 246 observations, 199 (or 81 per cent.) fall between 34.0°

and 36.0°, which may be regarded as the normal temperature at these depths within the region under consideration.

Let us examine the extreme readings, *i.e.*, those below 34.0° and those above 36.0°. Commencing with the lower readings, we find that the minimum temperature of 31.8° was observed at 2,634 fathoms, to the south-west of Savaii, Samoan group, lat. 14¾° S., and in the same serial the low temperature of 33.2° is recorded at 2,088 fathoms, nearly 600 fathoms above the bottom. The next lowest reading is one of 32.5°, observed at 2,394 fathoms, to the south-east of Wallis Island, lat. 13½° S. There is one reading of 33.2° at 2,835 fathoms, south of Savaii, Samoan group, lat. 14½° S. There is a reading of 33.4° observed by the "Albatross" between the Society and Fiji groups, lat. 19° S. There are two readings of 33.5°,—one at 2,680 fathoms between the Union group and Gente Hermosa, lat. 10½° S., the other at 3,006 fathoms in the neighbourhood of the great deeps, south of the Friendly Islands, lat. 24¾° S. There is one reading of 33.6°, near the last-mentioned in 2,889 fathoms. There are four readings of 33.7° also in the neighbourhood of the great deeps, about lat. 25° S., in 2,990, 3,036, 3,110, and 4,428 fathoms. There are no fewer than seven readings of 33.8°,—three of these are in the deep basin off the east coast of Australia, one at 2,379 fathoms, lat. 28¾° S., another farther south in 2,480 fathoms, lat. 30¼° S., and the third still farther to the south-west, east of Sydney, in 2,660 fathoms, lat. 33¾° S., a fourth reading occurs at 2,606 fathoms, to the south of the Union group, lat. 11° S., a fifth farther south in 2,600 fathoms, to the south of Savaii, Samoan group, lat. 14½° S., and the remaining two were observed farther to the south-east, to the east of the great deeps, one in 2,740 fathoms, lat. 23° S., the other in 2,780 fathoms, lat. 25¾° S., long. 161¾° W. There are two readings of 33.9°,—one in the deep basin off the east coast of Australia, to the north-east of Sydney, in 2,908 fathoms, lat. 33° S., the other to the east of Savage Island, lat. 19° S.

It thus appears that the low readings occur in three widely separated localities. The three lowest recorded readings, as well as three readings slightly higher, were observed in the north-eastern part of the region, in the neighbourhood of the Union and Samoan groups. Six of the readings are in the neighbourhood of the great deeps to the south of the Friendly Islands, with four observations much farther to the east. Finally there are four observations in the deep basin to the east of Australia.

Proceeding now to the higher readings, we find that the two readings at the maximum temperature of 37.8° were taken in the deep basin lying between New Zealand and the Fijis, one at 2,043 fathoms in

lat. 21¾° S., the other much farther south at 2,360 fathoms in lat. 29° S. There is one reading of 37.3° at 2,023 fathoms, and one reading of 37.2° at 2,186 fathoms, to the south-west of Duke of Clarence Island, Union group. There are no fewer than seven observations at 37.0°—one at 2,051 fathoms, off Duke of Clarence Island, Union group, another farther to the south-west, lat. 10¾° S., in 2,665 fathoms, another still farther to the south-west, off Lalla Rookh Bank, in 2,010 fathoms, another off the island of Funafuti, Ellice group, in 2,298 fathoms, one in the Coral Sea, off Indispensable Reefs, in 2,373 fathoms, one in the deep basin between New Zealand and Fiji, lat. 27½° S., in 2,295 fathoms, and finally one at 3,350 fathoms in the neighbourhood of the great deeps north-east of the Kermadec Islands, lat. 26½° S. There are two readings of 36.9°,—one at 2,310 fathoms to the south-west of the Union group, lat. 10½° S., the other in 3,220 fathoms in the neighbourhood of the great deeps south-east of the Kermadecs, lat. 32¼° S. There is one reading of 36.8° in the deep basin between New Zealand and Fiji in 2,327 fathoms, lat. 26¾° S. There are two readings at 36.6°,—one at 2,245 fathoms near Duke of Clarence Island, Union group, the other off Lalla Rookh Bank in 2,225 fathoms. There are three readings at 36.5°,—one in 2,560 fathoms, to the south-west of the Union group, latitude 11¼° S., the other two in the deep basin to the north of New Zealand, one at 2,263 fathoms about mid-way between New Zealand and Norfolk Island, lat. 31½° S., the other in 2,150 fathoms to the north-east of Norfolk Island, lat. 27° S. There are two readings of 36.4°,—one in the deep basin to the north of New Zealand in 2,438 fathoms, about mid-way between New Zealand and Norfolk Island, lat. 31¼° S., the other in 2,525 fathoms, between New Caledonia and the New Hebrides, lat. 18° S. There are three readings of 36.3°,—one at 2,420 fathoms, to the north-east of the Union group, lat. 8½° S., another in 2,553 fathoms to the south-west of the Union group, lat. 11¾° S., and the third at 2,270 fathoms in the deep basin between New Zealand and Fiji, lat. 28° S. There is one reading of 36.2° at 2,240 fathoms, south of the southern point of San Cristoval Island, Solomon group. There are two readings of 36.1°,—one in 2,750 fathoms to the south of San Cristoval Island, Solomon group, lat. 11½° S., the other at 2,583 fathoms, to the south-west of the Union group, lat. 11° S.

It will be observed that these high readings also occur at widely separated localities, but it is curious to note that the majority are recorded in the same locality as the lowest readings, viz., in the north-eastern part of the region under consideration in the neighbourhood of the Union and Samoan groups. The highest readings recorded at these depths as well as several slightly lower, were observed in

the deep basin to the north of New Zealand. Some of these observations are much higher than the neighbouring readings at similar depths, for instance, the readings of 37.8° at 2,360 fathoms, 37.0° at 2,295 fathoms, and 36.8° at 2,327 fathoms are surrounded by readings of 35.2 to 35.8°. Two of the readings (36.9° and 37.0°) are recorded in the neighbourhood of the great deeps in close proximity to readings two to three degrees lower ; for instance the reading of 37.0° at 3,350 fathoms is in the neighbourhood of two much lower readings at lesser depths, viz., 34.1° at 2,420 fathoms and 35.0° at 1,975 fathoms. The reading of 37° at 2,373 fathoms in the Coral Sea, west of the Indispensable Reefs, is not far from a reading of 35.8° at 1,552 fathoms. The high reading of 37° at 2,298 fathoms off Funafuti is in accordance with the other two observations recorded in the same locality, viz., 39.6° at 1,768 fathoms and 39.0° at 1,348 fathoms, which are all very high when compared with the general run of the observations at similar depths.

An interesting illustration of the distribution of temperature as affected by the contour of the bottom is recorded within the basin between New Zealand and Fiji :—On the 16th May, 1895, while running a line of soundings between New Zealand and Fiji, the " Waterwitch " came across a rise with 1,260 fathoms on it, apparently surrounded on all sides by water over 2,200 fathoms in depth. The temperature obtained on the summit of the rise, in 1,260 fathoms, was 36.2° ; in 2,410 fathoms to the south of the bank the temperature was 35.4°, in 2,280 fathoms to the west of the bank the temperature was 35.6°, in 2,260 fathoms to the east of the bank the temperature was 35.8, *but* in 2,270 fathoms to the *north* of the bank the temperature was found to be 36.3°, or 0.1° higher than was observed on the summit of the bank 1,000 fathoms nearer the surface. It seems probable from these observations that the water was flowing in a northerly direction, and that before reaching the deep water to the north it must have flowed over the summit of the rise, where it acquired a slightly higher temperature.

In the preceding discussion we have included all observations in depths exceeding 2,000 fathoms down to the greatest depths. There are twenty-one observations recorded in depths between 3,000 and 4,000 fathoms, ranging from 33.5° to 37.0°, with a mean of 34.8°, and three observations in depths exceeding 4,000 fathoms, ranging from 33.7° to 34.5°, with a mean of 34.1°. The lowest reading beyond 3,000 fathoms is 33.5° at 3,006 fathoms, in the neighbourhood of the great deeps to the south of the Friendly Islands, and the highest readings are 37.0° at 3,350 fathoms and 36.9° at 3,220 fathoms, farther to the south in the same neighbourhood. These two high readings are

about 1½° higher than any other observation at these depths. The greatest depth at which the bottom temperature is recorded is 4,762 fathoms, east of Tongatabu, Friendly Islands, the temperature being 34.5°.

From the observations given in this paper it seems impossible to trace any relation, in deep water beyond 2,000 fathoms, between the temperature of the bottom water and the depth; the general rule which applies to the intermediate waters, of decrease of temperature with increase of depth, does not appear to hold good with reference to these deep water bottom temperatures. Considering that the extreme range of temperature shown by all the bottom observations in depths greater than 2,000 fathoms does not exceed 6° F., it is perhaps not surprising that the slight variations do not apparently follow any definite direction with relation to the depth.

III. Marine Deposits of the South-West Pacific.

During the cruise of H.M.S. "Penguin" at the end of 1895 and beginning of 1896 a few very deep soundings were obtained, the depth exceeding anything previously known. We have had the opportunity of examining the deposits taken at these great depths, through the kindness of the late Admiral Sir W. J. L. Wharton, Hydrographer of the Admiralty, as well as many hundreds of other deposits from this region, including over 40 samples collected by H.M.S. "Challenger" in 1874, over 60 samples by U.S.S. "Tuscarora" in 1875 and 1876; about 20 samples by H.M.S. "Myrmidon" in 1887; about 420 samples by H.M.S. "Egeria" in 1888, 1889, and 1890; about 200 samples by H.M.S. "Penguin" in 1894, 1895, and 1896; and about 50 samples by H.M.S. "Waterwitch" in 1895.

The number of samples examined may be tabulated, according to depth, as follows:—

From shallow water under 100 fathoms	77 samples
depths between 100 and 500 fathoms	133 ,,
,, ,, ,, 500 and 1000 ,, ...	150 ,,
,, ,, ,, 1000 and 1500 ,, ...	161 ,,
,, ,, ,, 1500 and 2000 ,, ...	118 ,,
,, ,, ,, 2000 and 2500 ,, ...	67 ,,
,, ,, ,, 2500 and 3000 ,, ...	43 ,,
,, ,, ,, 3000 and 3500 ,, ...	18 ,,
,, ,, ,, 3500 and 4000 ,, ...	3 ,,
,, ,, ,, 4000 and 4500 ,, ...	1 ,,
,, ,, ,, 4500 and 5000 ,, ...	0 ,,
,, ,, over 5000 fathoms	2 ,,
Total ..	773 ,,

In addition, we have made use of the descriptions of the deposits collected by the German ship "Gazelle," of which over twenty samples fall within the scope of this paper.

This mass of material has enabled us to prepare a map of the region (see Map IV.) showing approximately the distribution of the various kinds of deposits, but in the northern parts of the region the information available is very meagre ; in fact we have no deposits from the area south of the equator lying between the Solomon, Santa Cruz, and northern portion of the New Hebrides groups across to the Ellice and Gilbert Groups and onwards to the Phœnix group.

All the principal varieties of deep-sea deposits are represented in the region under consideration, with the exception of Diatom Ooze, which occurs farther to the south, forming apparently a continuous band of varying width around the world in the south polar regions northwards of the zone of Blue Mud bordering the Antarctic Continent. We may also remark that the local variety of terrigenous deposits called Red Mud, hitherto known only from the coast of Brazil and the Yellow Sea, appears also to be absent from this region. In the appendix we give detailed descriptions, on the plan adopted in the Challenger Report on Deep-Sea Deposits, of a series of samples from various parts of the region. In these descriptions the percentages placed within parentheses ( ) are the results of chemical analyses, while those placed within brackets [ ] are the results of approximate evaluations.

From an examination of Map IV. it will be observed that the bottom over by far the greater part of the region is covered by Globigerina Ooze and Red Clay in nearly equal proportions, the Globigerina Ooze probably predominating to a slight extent. The Red Clay occupies all the deepest parts of the region, except for a small patch of Radiolarian Ooze, extending southwards from the equator for about 13° of lat. on the meridian of 170° W. The Globigerina Ooze covers the sea-floor in medium depths (1,000 to 2,300 fathoms), with a few scattered patches of the closely-related Pteropod Ooze in lesser depths, mostly under 1,000 fathoms. Coral Mud occurs along the Great Barrier Reef of Australia and around all the reefs and islands of coral formation. In the neighbourhood of volcanic islands, and near some banks recently investigated, Volcanic Mud is found, and, further, some of the deposits from the very deep water extending from Samoa southwards as far as about lat. 33° S., which have been classed as Red Clays, might with equal propriety have been called Volcanic Muds, for the abundance of volcanic debris in these deposits is a marked peculiarity, making up in some cases as much as 50 per cent. of the whole deposit. Blue Mud and Green Mud occur around the coasts of Australia, New Zealand, Chatham Islands and other larger islands not of volcanic origin.

The following table shows the approximate area covered by each variety of deposit in square geographical and English miles, and the percentage of the total water-surface—which, as stated in the Introduction, is estimated at about 11,000,000 square English miles.

	Approximate area in square *Geographical* miles.	Approximate area in square *English* miles.	Percentage.
Globigerina Ooze	3,983,800	5,280,600	48.0
Red Clay	3,644,900	4,831,500	44.0
Blue and Green Muds	353,400	468,400	4.3
Volcanic Mud	134,300	178,100	1.6
Coral Mud	131,400	174,200	1.6
Pteropod Ooze	29,200	38,700	0.4
Radiolarian Ooze	11,700	15,500	0.1
Total	8,288,700	10,987,000	100.0

I. Globigerina Ooze.

This is the predominant form of deposit in this region, covering as it does about 48 per cent. of the sea-floor. It ranges in depth from 610 to 2,835 fathoms, but the great majority of the samples are from depths between 1,000 and 2,000 fathoms, showing that it is a deposit characteristic of medium depths ; indeed the extreme depths mentioned above are exceptions due to special circumstances. The deposit from 610 fathoms, off the reefs at Kandavu, Fiji, is on the boundary line between Globigerina Ooze and Coral Mud, and has been included among the Globigerina Oozes because of the abundance of shells of pelagic Foraminifera, which make up half of the carbonate of lime present. Another Globigerina Ooze from a similar depth, 630 fathoms, situated to the south of lat. 35° S., illustrates the effect of latitude on the distribution of pelagic organisms, for at such depths within the tropics some distance from land the deposit is usually a Pteropod Ooze, whereas in this case the shells of pelagic Foraminifera make up the mass of the carbonate of lime present. The deposit from 2,835 fathoms, between Birnie and Enderbury Islands of the Phœnix group, might almost have been called a Radiolarian Ooze, so numerous are the remains of these siliceous organisms, but it contains 42 per cent. of carbonate of lime, an exceptionally high percentage for such a great depth, which remark applies also to a sample from 2,800 fathoms off the east coast of New South Wales, lat. 33° S., where the percentage of carbonate of lime is over 45, the calcareous matter being mostly in an amorphous condition and the pelagic Foraminifera shells fragmentary, while there is a great admixture of amorphous clayey matter.

But it is in depths of 1,500 to 2,000 fathoms that we find this kind of deposit in its most typical form, though the species of pelagic Foraminifera predominating, or even represented, in different samples,

vary considerably according to latitude. For the sake of comparison we give here a table showing the species of pelagic Foraminifera observed in five Globigerina Oozes within the region under consideration, arranged according to latitude from the equator southwards to 45° S. :—

	I. lat. 0° 42′ S. North of the Admiralty Is. 1,100 fms.	II. lat. 15° 58′ S. Coral Sea, 2,325 fms.	III. lat. 19° 2′ S. near Fiji Is., 1,350 fms.	IV. lat. 37° 53′ S. between New Zealand and Australia, 1,975 fms.	V. lat. 45° 11′ S. South of Chatham Is. 1,381 fms.
Orbulina universa	†	†	†	†	†
Globigerina bulloides . .	†		†	†	†
,, rubra . .	†		†		
,, conglobata . .	†	†	†		
,, æquilateralis . .	†	†	†	†	
,, dubia . .	†	†	†	†	†
,, inflata . .	†	†	†	†	†
,, sacculifera . .	†	†	†		
,, digitata . .	†	†			
Hastigerina pelagica . .			†		
Sphæroidina dehiscens . .	†	†	†	†	
Pullenia obliquiloculata . .	†	†	†	†*	
Candeina nitida	†		†		
Pulvinulina menardii . .	†	†	†		
,, tumida . .	†	†	†		
,, canariensis . .	†		†	†	
,, micheliniana	†*	†	†	†	†
,, crassa . .		†	†	†	†

*Single specimen only observed.

This list includes all the species of Foraminifera known to have a pelagic habitat, with three exceptions, viz., (1) *Globigerina cretacea*,[*] a very doubtful species apparently closely related to *Globigerina dubia* ; (2) *Globigerina dutertrei*,[†] a form characteristic of the colder waters of the globe and related to *Globigerina inflata* ; (3) *Cymbalopora bulloides*,[‡] a fragile tropical form abundant in some coral-reef regions, the shells of which are seldom, if ever, found at the bottom in depths over 1,000 fathoms ; *Hastigerina pelagica*[‖] was observed in one of the deposits from these five stations and young examples were present,

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*" *Globigerina cretacea* resembles *Globigerina dubia* . . . . I have never met with recent specimens either among surface organisms or in bottom-ooze which presented exactly the same characters as the typical Cretaceous variety ; though shells similar in general conformation, and more nearly related to *Globigerina cretacea* than to any other recognised modification of the genus, are not uncommon in certain localities" (H. B. Brady, Zool. Chall. Exp., part 22, pp. 593-7, 1884).

†" *Globigerina dutertrei* is a starved variety which to some extent takes the place of the typical *Globigerina bulloides* in the Antarctic seas, just as *Globigerina pachyderma* represents the type in Arctic latitudes" (Brady, *op. cit.*, p. 601).

‡" *Cymbalopora bulloides* has long been known as a bottom Foraminifer . . . . but on the Challenger cruise it was frequently taken in the tow-nets at the surface of the sea, always in shallow areas and in the mmediate neighbourhood of coral-reefs . . . . . Bottom specimens have been collected off the Admiralty Islands, the New Hebrides, around the Fiji group, &c." (Brady, *op. cit.*, pp. 639-40).

‖" A few of the thicker shelled specimens [of *Hastigerina pelagica*] are found from time to time in bottom dredgings, but they are by no means common, and are seldom even approximately complete. The spines are invariably broken off, and when the shells are not otherwise fractured the surfaces are worn and the texture rotten" (Brady, *op. cit.*, p. 614).

in a few other bottoms, but the full-grown specimens of this species have very fragile shells, which offer but a feeble resistance to the processes of disintegration, and usually reach the bottom in moderate depths only in a fragmentary condition.

It will be observed from the table that of the eighteen species enumerated four are common to the five stations, viz., *Orbulina universa*, *Globigerina dubia* and *inflata*, and *Pulvinulina micheliniana*. The absence of *Globigerina bulloides*, a common and widely-distributed form, from station No. II. may be accidental or may perhaps be due to the great depth, which would also account for the absence of *Globigerina rubra*, *Candeina nitida*, and *Pulvinulina canariensis*. Of *Pulvinulina micheliniana* only a single example was observed in the equatorial station (No. I.), and it appears to be characteristic rather of subtropical than tropical regions ; the same remark applies to *Pulvinulina crassa* (probably a variety of *Pulvinulina micheliniana*), the only species of *Pulvinulina* unrepresented at the equatorial station (No. I.).

The station which practically includes all the species is No. III., near the Fiji Islands, the only absentee being *Globigerina digitata*, a species of very limited distribution and a mere variety of *Globigerina sacculifera*. The two most southerly stations (Nos. IV. and V.) contain fewer species than the other three stations within the tropics, and at the same time the examples are of smaller size ; this is especially noticeable in No. V., where the Foraminifera are all of a nearly uniform small size, the bulk of the material being made up of specimens of *Globigerina dubia* and *inflata*, the remaining four species being few in number.

On the other hand, it is those species with large massive shells that are specially characteristic and abundant in the tropical stations, such, for instance, as *Globigerina conglobata* and *sacculifera*, *Pullenia obliquiloculata*, *Pulvinulina menardii* and *tumida*, which were all unrepresented in the most southerly station (No. V.), and were represented in lat. 38° S. (No. IV.) only by a single specimen of *Pullenia obliquiloculata* and by three examples of *Sphæroidina dehiscens*.

Of the calcareous remains of organisms other than Foraminifera in the Globigerina Oozes coccoliths are the most common, having been found in nearly every sample examined from the region under consideration. Sometimes they are not numerous and are very minute, at other times they are very abundant and often of large size. It is in the southern parts of the region that the coccoliths attain their greatest development ; between lat. 35° and 46° S. extremely large coccoliths were observed in some of the deposits. It was only in these same southern

latitudes (between Australia and New Zealand and near Chatham Islands, lat. 37° to 45° S.) that coccospheres were present in the deposits, whereas rhabdospheres were not observed in any of the samples, being apparently broken up into their component parts (the rhabdoliths). Rhabdoliths were usually observed in the samples from the tropical areas in company with coccoliths, though seldom so abundant and in some cases very difficult of detection.

The colour of the Globigerina Ooze varies strikingly with latitude within this region of the South-West Pacific, those samples from the southerly parts of the region being of a pure or cream white colour, while nearer the equator the deposit assumes a fawn or light brown colour, deepening in many cases into a dark brown, sometimes almost chocolate colour, due to the greater or less abundance of the peroxides of manganese and iron. At its deep margin the Globigerina Ooze passes gradually into the Red Clay, while at its shallow margin it may becomea Coral Mud in the vicinity of coral reefs, or a Volcanic Mud near volcanic centres, or a Blue Mud or Green Mud on approaching the continents and continental islands, or a Pteropod Ooze within tropical areas removed from coral reefs and volcanic centres.

II. Pteropod Ooze.

This deposit is closely related to the Globigerina Ooze, for the name is applied to those deposits which differ from the Globigerina Ooze simply in the comparative abundance of the shells of pelagic Molluscs, and as these shells are apparently more quickly removed by the solvent action of sea-water than the smaller but thicker Foraminiferous shells, it follows that it is found in lesser depths than the Globigerina Ooze, passing gradually at its deeper margin into the latter deposit. It is usually found in depths between 500 and 1,000 fathoms, the shallowest sample within this region being from 305 fathoms, and the deepest 1,102 fathoms. It is limited to tropical and subtropical waters, the most southerly latitude at which it has been observed in this area being 30° S. on the meridian of 180°. It occurs in the Coral Sea in those places where the bottom rises into banks or plateaus less than 1,000 fathoms below the surface, but beyond the range of coral reefs, and in this locality it is found in closer proximity to a continental shore than in any other part of the world. This may be explained by the facts that no large rivers enter the sea and the coast is guarded by the Great Barrier Reef, the seaward face of which is bathed by pelagic waters, so that within two hundred miles from the shore a Pteropod Ooze may be found.

III. Red Clay.

As will be seen from the Table, this deposit is inferior in extent in the region under consideration only to the Globigerina Ooze, cover-

ing the bottom as it does over about 44 per cent. of the total water surface.

The Red Clay occupies all the deepest parts of the region, covering the bottom to the east of about 175° W. longitude, where the depth exceeds at some points 5,000 fathoms, representing the south-western boundary of the great Red Clay area of the Pacific ; a second area occurs in the deep water lying between New Zealand and the Fiji Islands (including a small patch of Globigerina Ooze where the bottom rises to 1,260 fathoms, surrounded on all sides by water over 2,200 fathoms in depth) ; a third area occurs to the east of Australia (the northern prolongation of a large tract occupying the sea between Australia and New Zealand), and, like the second area, includes a patch of Globigerina Ooze in comparatively deep water, viz., 2,370 and 2,800 fathoms ; a fourth area—or rather two areas joined together by a narrow neck between Rennell and Bellona Islands and the Solomon group—occurs in the Coral Sea and in the sea lying between the New Hebrides group and the Loyalty Islands and New Caledonia ; there are indications of a fifth area of Red Clay extending on both sides of the equator in long. 157° to 174° E.

The depth at which the Red Clay was found varies from 2,180 to 5,155 fathoms, and the percentage of carbonate of lime ranges from 20 per cent. in 2,180 fathoms to 0 in the greater depths. The calcareous organisms observed consisted of pelagic and bottom-living Foraminifera, fishes' teeth, Echini spines, and coccoliths ; the last-named were only present in the shallowest sample, 2,180 fathoms.

The mineral particles ranged from 1 to 50 per cent. ; those samples with a high percentage always contained a large amount of pumice and other volcanic material and might be designated Volcanic Muds. The minerals consisted of pumice, magnetite, augite, hornblende, felspars, palagonite, manganese grains, glassy particles, volcanic rock fragments, and quartz, which last was noticed only in two bottoms situated to the south-east of Chatham Islands, in 2,793 and 2,881 fathoms.

The siliceous organisms ranged from 0 to 10 per cent., consisting of Radiolaria (including Challengeridæ in some cases), Sponge spicules, arenaceous Foraminifera, and Diatoms.

The " fine washings " ranged from 35 to 96 per cent., but where the percentage was less than 70 the samples contained a high percentage of minerals (principally pumice) and might be called Volcanic Muds. The fine washings were made up in all cases of amorphous clayey matter with minute mineral particles less than 0.05 mm. in diameter (chiefly pumice).

IV. Radiolarian Ooze.

This deposit, which may be looked upon as a variety of the Red Clay differing only in the comparative abundance of the skeletons of Radiolaria, covers a small area in this region. Up till 1900 only three samples had passed through our hands, taken by the U.S.S. "Tuscarora" in 1875, and the amount of material available was insufficient for detailed examination and description; they were situated just under the equator on the meridian of 170° W. southwards towards the Phœnix Islands, in depths of 3,020, 3,015, and 2,865 fathoms. A little farther south, among the Phœnix Islands, two samples from 2,835 and 3,000 fathoms contained a large proportion of Radiolaria, but have been classed among other deposits: the first among the Globigerina Oozes, as it contains 42 per cent. of carbonate of lime due principally to pelagic Foraminifera, and the second among the Red Clays. Subsequently, however, the examination of several series of recent soundings has shown that Radiolarian Ooze covers a pretty extensive area in this locality, as indicated on Map IV.

V. Volcanic Mud.

Volcanic material plays a very important part in the deposits of the region under consideration, being present in less or greater abundance in every sample examined, principally in the form of pumice and volcanic glass. As already stated, some of the Red Clays from deep water might equally well be called Volcanic Muds so abundant are the fragments of volcanic origin. But it is around and between the various groups of volcanic islands, such as the Kermadecs, Friendly Islands, Samoan Islands, Fijis, New Hebrides, Santa Cruz Island, and some of the Solomon Islands, that we find Volcanic Mud in its most characteristic form.

The samples ranged in depth from 302 to 2,427 fathoms, while from a depth of 2,835 fathoms, to the south-west of Samoa, the sounding tube brought up some fragments of volcanic rock and volcanic glass, the largest 5 mm. in diameter, mostly converted into palagonite and coated with manganese.

The percentage of carbonate of lime ranged from 5 to 40 per cent., due to pelagic and bottom-living Foraminifera, fragments of Pteropods and Lamellibranchs, Echini spines, Ostracodes, otoliths of fishes, Coral fragments, coccoliths, rhabdoliths, and Tunicate spicules.

The mineral particles ranged from 10 to 60 per cent., and consisted of pumice, volcanic glass and rock fragments, palagonite, manganese grains, olivine, mica, felspar, obsidian.

The siliceous organisms made up 1 to 5 per cent., consisting of Sponge spicules, Radiolaria, arenaceous Foraminifera, Diatoms, and imperfect casts of calcareous organisms.

The fine washings ranged from 18 to over 60 per cent., being usually minute splinters of pumice and other volcanic materials along with amorphous clayey matter.

VI. Blue Muds and Green Muds.

These deposits occur chiefly around New Zealand and Chatham Island and off the southern coasts of Australia. They are very largely made up of detrital matter washed down from the land and carried into the ocean by rivers. The Blue Muds occur especially close to the embouchures of large rivers, where the deposit is formed at a relatively rapid rate. At a considerable distance from the coast they may have a large number of pelagic shells, and in some positions the deposit may gradually pass into a Globigerina Ooze.

At other parts of the coast the Blue Muds pass into Green Muds, characterised by the presence of glauconite. This deposit is evidently formed less rapidly than the Blue Mud. It contains less detrital matter than the Blue Mud and pelagic conditions approach nearer to the shore where Green Muds are found than in other places. Green Muds are also found in their greatest development in those regions where warm currents occupy the surface at one time of the year and cold currents at another. Such an area is found off the coasts of New South Wales, where the warm Australian current from the north mingles with the Antarctic drift from the south. Here the "Challenger" found much glauconite in the deposits, the Foraminifera being largely filled with the most perfect casts of glauconite, and there were also phosphatic concretions in the deposit.

IV. Distribution of Carbonate of Lime ($Ca\ CO_3$) over the Floor of the Ocean.

By far the larger part of the carbonate of lime which is found in the marine deposits now covering the floor of the ocean has been derived from sea-water through the action of organisms. The carbonate of lime derived from minerals may for the present be wholly neglected, for in no case does it amount to one per cent. in any of the varieties of marine deposits referred to in this paper. The carbonate of lime found in marine deposits is made up of the fragments of Fish bones, Mollusc shells, Corals, spicules of Tunicates and Sponges, shells of Foraminifera, remains of calcareous Algæ, and indeed of remains of all the calcareous structures secreted by marine organisms. A very important division may be made in these calcareous remains into two classes :—viz., those which have been secreted by organisms

which live habitually in the surface and subsurface waters of the ocean, such as pelagic Molluscs, pelagic Foraminifera, and calcareous Algæ, viz., Pteropods, *Globigerina*, *Pulvinulina*, *Orbulina* and several other genera of Foraminifera, and coccospheres and rhabdospheres. The remains of all these pelagic (plankton) organisms are especially abundant in the deposits far from land. Near the land their presence is masked by detrital matters. In great depths they disappear, being dissolved by the action of sea-water either while falling to the bottom or soon after they reach the bottom. In depths of 1,000 fathoms far from land they may make up fully 95 per cent. of the deposit.

The organisms which live on the bottom of the ocean (benthos), viz., Corals, Molluscs, Foraminifera (of very different species from those of a pelagic habitat), calcareous Algæ, are very poorly represented in deep water, but in shallow water their remains may make up nearly the whole of the deposit now in process of formation. This is especially the case around coral islands.

In Map V. we have represented the result of a very large number of analyses of the amount of carbonate of lime in the samples of deposits which have passed through our hands from this region of the ocean. The map is specially interesting when compared with the other maps showing depth, temperature and deposits. It will be observed that the dark shades of blue, which represent the high percentages of carbonate of lime, correspond to the shallower depths of the ocean in the depth Map (II.) and to the shore regions where coral reefs prevail. Away from the coasts the deep shades correspond with the distribution of the Globigerina and Pteropod Oozes on the deposit Map (IV.). Again, the faintest shades of blue on the map correspond with the deep water on the depth map, and with the Red Clays in the deposit map. It is well known that carbonate of lime is very sparingly secreted in the cold water either of the polar regions or of the deep sea, while it is very abundantly secreted in warm seas where there is a nearly uniform temperature throughout the year. In warm water the lime is secreted in the form of aragonite, while in the cold water it appears in the form of calcite. In this connection it may be remarked that in the deposits now forming on the floor of the ocean the remains of organisms may be found which during their lives existed always in a temperature of 35° F., mixed up with the remains of organisms which always lived in a temperature of about 80° F. This shows how difficult it may be to unravel the geological records of the past, for the remains of organisms which lived under wholly different conditions may be mixed up in the same strata.

In the collection of the data for this paper, and in the preparation

of the manuscript and maps I have been largely assisted by Mr. James Chumley, Mr. Robert Dykes, Mr. C. E. Wragge, and Mr. Fred. Pearcey, assistants in the Challenger Office, Edinburgh.

APPENDIX I.

Detailed Descriptions of Typical Deposits from the South-West Pacific.

H.M.S. "Egeria," Sounding 8, 30 April, 1889, lat. 34° 00½′ S., long. 166° 21½′ E., 1,656 fathoms.

GLOBIGERINA OOZE, creamy white when dry, grey when wet, chalky.

Calcium carbonate (85.3%), principally pelagic Foraminifera (Globigerinidæ, Pulvinulina), coccoliths and rhabdoliths.

Residue (14.7%)

Minerals [2%], m.di. 0.2 mm., pumice chiefly; one piece of quartz 0.4 mm. in diameter observed.

Siliceous Organisms [5%], Radiolaria, Sponge spicules, Diatoms.

Fine Washings [7.7%], amorphous clayey matter.

U.S.S. "Tuscarora," 25 December, 1875, lat. 3° 21′ S., long. 171° 23′ W., 2,835 fathoms.

GLOBIGERINA OOZE (with many Radiolaria), fawn colour, fine grained.

Calcium carbonate (42.09%), pelagic Foraminifera, mostly in a fragmentary condition, numerous coccoliths (some very large), Tunicate spicules, and much crystalline and amorphous calcareous matter.

Residue (57.91%)

Minerals [1%], a few manganese grains, palagonitic and glassy particles.

Siliceous Organisms [25%], Radiolaria, Diatoms, Sponge spicules, and one or two small arenaceous Foraminifera.

Fine Washings [31.91%], amorphous clayey matter.

H.M.S. "Penguin," Sounding 263, 10 August, 1895, lat. 16° 23′ S., long. 178° 2′ 45″ W., 1,497 fathoms.

GLOBIGERINA OOZE, fawn colour.

Calcium carbonate [80%], pelagic Foraminifera (many young), one or two bottom-living Foraminifera, coccoliths, rhabdoliths.

Residue [20%]

Minerals [5%], pumice, magnetite.

Siliceous Organisms [1%], Radiolaria (including Challengeridæ), Sponge spicules.

Fine Washings [14%], amorphous clayey matter and minute mineral particles.

H.M.S. "Penguin," Sounding 118, 17 August, 1894, lat. 23° 2.3′ S., long. 156° 36.2′ E., 1,085 fathoms.

GLOBIGERINA OOZE, cream colour when wet, white when dry.

Calcium carbonate [80%], pelagic and bottom-living Foraminifera (with many young forms), Ostracodes, Echini spines, coccoliths, rhabdoliths.

Residue [20%]

Minerals [1%], pumice (one piece about 2 mm. in diameter observed).

Siliceous Organisms [3%], Sponge spicules, Radiolaria, Diatoms, a few brown casts and arenaceous Foraminifera.

Fine Washings [16%], amorphous clayey matter and minute fragments of minerals and siliceous organisms.

H.M.S. "Penguin," Sounding 120, 18 August, 1894, lat. 24° 23.2′ S., long. 155° 46.7′ E., 2,400 fathoms.

GLOBIGERINA OOZE, fawn colour when wet, creamy white when dry.

Calcium carbonate (52.0%), pelagic and bottom-living Foraminifera (mostly fragmentary or of small size), coccoliths, rhabdoliths.

Residue (48.0%)

Minerals [5%], m.di. 0·09mm., quartz, felspar, olivine, magnetite.

Siliceous Organisms [1%], Sponge spicules.

Fine Washings [42%], morphous clayey matter and small mine al particles.

H.M.S. "Penguin," Sounding 73, 8 August, 1894, lat. 22° 49·9′ S., long. 155° 17.6′ E., 1,760 fathoms.

GLOBIGERINA OOZE, of a pale fawn colour.

Calcium carbonate [80%], pelagic and bottom-living Foraminifera, otoliths, Echini spines, coccoliths, rhabdoliths, and a few Tunicate spicules.

Residue [20%]

Minerals [3%], volcanic particles, quartz.

Siliceous Organisms [1%], Sponge spicules.

Fine Washings [16%], amorphous clayey matter and minute mineral particles.

H.M.S. "Penguin," Sounding 68, 21 June, 1894, lat. 35° 41.2′ S., long. 151° 15.5′ E., 2,666 fathoms.

GLOBIGERINA OOZE, of a greenish grey colour.

Calcium carbonate [40%], pelagic and bottom-living Foraminifera, a few Pteropod fragments, Echini spines, coccoliths (very large), and many Tunicate spicules.

Residue [60%]

Minerals [10%], quartz, volcanic glass and other volcanic particles, mica, felspar, glauconite, black spherules (manganese?).

Siliceous Organisms [5%], Sponge spicules.

Fine Washings [45%], amorphous clayey matter and minute mineral particles.

H.M.S. "Penguin," Sounding 251, 8 August, 1895, lat. 18° 18.5′ S., long. 179° 19.5′ E., 1,500 fathoms.

GLOBIGERINA OOZE, of a light brown colour.

Calcium carbonate [80%], pelagic and bottom-living Foraminifera (with many young forms), coccoliths, rhabdoliths, and a few Tunicate spicules.

Residue [20%]

Minerals [3%], pumice fragments, some showing signs of alteration.

Siliceous Organisms [2%], Sponge spicules and arenaceous Foraminifera.

Fine Washings [15%], amorphous clayey matter and minute particles of pumice.

H.M.S. "Penguin," Sounding 258, 9 August, 1895, lat. 17° 9.6′ S., long. 179° 50.6′ W., 1,047 fathoms.

GLOBIGERINA OOZE, fawn colour.

Calcium carbonate [75%], pelagic Foraminifera (including many young forms), a few Pteropods, Ostracodes, coccoliths, rhabdoliths, and Tunicate spicules.

Residue [25%]

Minerals [8%], volcanic glass, pumice, olivine; one piece of pumice 4.5mm. in diameter observed.

Siliceous Organisms [3%], Sponge spicules, Radiolaria, and Diatoms.

Fine Washings [14%], amorphous clayey matter and minute mineral particles.

H.M.S. "Penguin," Sounding 256, 9 August, 1895, lat. 17° 31.6′ S., long. 179° 54.7′ W., 1,374 fathoms.

GLOBIGERINA OOZE, fawn colour

Calcium carbonate [80%], pelagic and bottom-living Foraminifera, Pteropods, coccoliths, rhabdoliths, many Tunicate spicules (making up probably 2 per cent. of the whole deposit).

Residue [20%]

Minerals [3%], pumice and other volcanic particles.

Siliceous Organisms [3%], Sponge spicules, Radiolaria, and Diatoms.

Fine Washings [14%], amorphous clayey matter and minute mineral particles.

H.M.S. "Penguin." Sounding 228, 1 August 1895, lat. 18° 22′ 54″ S., long. 177° 8′ 8″ W., 1,211 fathoms.

GLOBIGERINA OOZE, of a brown colour.

Calcium carbonate [60%], pelagic and bottom-living Foraminifera with a large proportion of young forms, otoliths, coccoliths, rhabdoliths, and amorphous calcareous matter.

Residue [40%], dark brown.

Minerals [10%], pumice and other volcanic material.

Siliceous Organisms [5%], Sponge spicules, Radiolaria, Diatoms.

Fine Washings [25%], minute mineral particles and amorphous matter.

H.M.S. "Waterwitch," Sounding 147, 29 May, 1895, lat. 17° 13′ S., long 179° 57′ W., 1,065 fathoms.

GLOBIGERINA OOZE, light brown in colour.

Calcium carbonate [70%], pelagic and bottom-living Foraminifera (with many young forms), Pteropod fragments, Ostracodes, Echini spines, coccoliths, rhabdoliths, Tunicate spicules. Some of the shells covered with manganese.

Residue [30%]

Minerals [10%], volcanic glass, pumice, palagonite, manganese grains.

Siliceous Organisms [2%], Sponge spicules, Radiolaria, arenaceous Foraminifera.

Fine Washings [18%], amorphous clayey matter and small mineral particles.

H.M.S. "Penguin," Sounding 230, 2 August, 1895, lat. 17° 25′ 49″ S., long. 177° 57′ 10″ W., 1,445 fathoms.

GLOBIGERINA OOZE, of a brown colour.

Calcium carbonate (62.7%), pelagic and bottom-living Foraminifera with many young forms, coccoliths, rhabdoliths.

Residue (37.3%), chocolate colour

Minerals [7%], principally pumice and associated minerals.

Siliceous Organisms [1%], Radiolaria, Sponge spicules, Diatoms.

Fine Washings [29.3%], amorphous clayey matter and minute mineral particles.

H.M.S. "Waterwitch," Sounding 106, 13 May, 1895, lat. 33° 10′ 18″ S., long. 173° 58′ 42″ E., 1,724 fathoms.

GLOBIGERINA OOZE, light grey in colour.

Calcium carbonate [75%], pelagic and bottom-living Foraminifera, coccoliths, rhabdoliths.

Residue [25%], dark brown.

Minerals [1%], pumice, blown particles of quartz, augite.

Siliceous Organisms [2%], Sponge spicules, Radiolaria, Diatoms, arenaceous Foraminifera.

Fine Washings [22%], amorphous clayey matter and small mineral particles

H.M.S. "Egeria," Sounding 6, 28 April, 1889, lat. 33° 36′ S., long. 161° 25½′ E., 946 fathoms.

GLOBIGERINA OOZE, grey when wet, nearly white when dry.

CALCIUM CARBONATE [75%], pelagic and bottom-living Foraminifera, Echini spines, coccoliths, rhabdoliths.

RESIDUE [25%], dark brown.

Minerals [4%], volcanic glass, pumice, palagonite, wind-blown quartz crystals covered with limonite.

Siliceous Organisms [4%], Sponge spicules, Radiolaria, Diatoms, arenaceous Foraminifera.

Fine Washings [17%], amorphous clayey matter and minute mineral particles.

H.M.S. "Waterwitch," Sounding 133, 20 May, 1895, lat. 18° 48′ 34″ S., long. 178° 0′ 30″ E., 1,180 fathoms.

GLOBIGERINA OOZE, brown.

CALCIUM CARBONATE [35%], pelagic and bottom-living Foraminifera, Pteropod fragments, Ostracodes, Echini spines, coccoliths, rhabdoliths, Tunicate spicules.

RESIDUE [65%]

Minerals [7%], volcanic glass, pumice, magnetite.

Siliceous Organisms [3%], Sponge spicules, arenaceous Foraminifera.

Fine Washings [55%], amorphous clayey matter and minute mineral particles.

H.M.S. "Penguin," Sounding 260, 9 August, 1895, lat. 16° 54.5′ S., long. 179° 32′ W., 779 fathoms.

GLOBIGERINA OOZE, of a light brown colour.

CALCIUM CARBONATE [75%], pelagic and bottom-living Foraminifera, otoliths, Echini spines, coccoliths, rhabdoliths, Tunicate spicules. Only one doubtful Pteropod fragment observed.

RESIDUE [25%], dark brown.

Minerals [5%], pumice (including a few large pieces) and other volcanic particles.

Siliceous Organisms [3%], Sponge spicules, Radiolaria, Diatoms, arenaceous Foraminifera.

Fine Washings [17%], amorphous matter and small mineral particles.

A sounding taken by H.M.S. "Waterwitch" near this position and at a similar depth (lat. 16° 56′ 10″ S., long. 179° 32′ 30″ W., 776 fathoms) differed from this deposit in the presence of numerous Pteropod shells and fragments, so that it would be called a Pteropod Ooze.

U.S.S. "Enterprise," lat. 45° 2′ S., 178° 21′ W., 996 fathoms.

GLOBIGERINA OOZE, white, with bluish tinge when wet.

CALCIUM CARBONATE [80%], pelagic and bottom-living Foraminifera, Echini spines, coccospheres, coccoliths (abundant and very large).

RESIDUE [20%]

Minerals [2%], quartz, manganese, glauconite, pumice.

Siliceous Organisms [3%], Sponge spicules, Diatoms, arenaceous Foraminifera.

Fine Washings [15%], minute fragments of minerals and amorphous clayey matter.

U.S.S. "Enterprise," lat. 45° 11′ S., long. 177° 53′ W., 1,381 fathoms.

GLOBIGERINA OOZE, light grey (nearly white), fine grained.

CALCIUM CARBONATE [70%], pelagic and bottom-living Foraminifera, Echini spines, coccoliths.

RESIDUE [30%]

Minerals [2%], pumice and glassy particles.

Siliceous Organisms [1%], Sponge spicules.

Fine Washings [27%], amorphous matter and small mineral particles.

H.M.S. "Egeria," Sounding 4, 26 April, 1889, lat. 33° 44′ S., long. 156° 0¾′ E., 2,800 fathoms.

GLOBIGERINA OOZE, greenish white, homogeneous, clayey, of a very fine texture.

CALCIUM CARBONATE (45.3%), fragments and young specimens of pelagic Foraminifera, coccoliths, rhabdoliths, Tunicate spicules, amorphous calcareous matter.

RESIDUE (54.7%), dark grey.

Minerals [2%], angular and rounded, m.di. 0.07mm.; principally pumice, augite, volcanic glass, one or two grains of quartz; some crystals covered with limonite.

Siliceous Organisms [1%], Sponge spicules, Diatoms.

Fine Washings [51.7%], amorphous clayey matter and minute mineral particles.

H.M.S. "Egeria," Sounding 2, 20 June, 1890, lat. 33° 1′ S., long. 170° 5.7′ E., 2,258 fathoms.

GLOBIGERINA OOZE, white, chalky, exceedingly fine in texture, most of the calcareous matter in an amorphous condition, very few of the Foraminifera shells being perfect.

CALCIUM CARBONATE [75%], pelagic Foraminifera, coccoliths.

RESIDUE [25%], brown.

Minerals [10%], angular and rounded pumice (one fragment of augitic pumice 5mm. in diameter), quartz, augite, hornblende, felspars.

Siliceous Organisms [5%], Sponge spicules, Radiolaria.

Fine Washings [10%], amorphous clayey matter, minute minerals, peroxides of iron and manganese.

H.M.S. "Penguin," Sounding 239, 3 August, 1895, lat. 17° 18′ S., long. 179° 56.2′ W., 491 fathoms.

PTEROPOD OOZE, fawn colour when wet, cream colour when dry. This sounding seems to indicate a rise surrounded on all sides by deeper water.

CALCIUM CARBONATE [80%], Pteropods, pelagic and bottom-living Foraminifera (with many young forms), otoliths, Ostracodes, Echini spines, Gasteropods, coccoliths, rhabdoliths, Tunicate spicules. Some of the shells covered with manganese.

RESIDUE [20%]

Minerals [5%], pumice, volcanic glass, palagonite, manganese grains.

Siliceous Organisms [2%], Sponge spicules, Radiolaria, arenaceous Foraminifera.

Fine Washings [13%], amorphous clayey matter and small mineral particles.

H.M.S. "Penguin," Sounding 243, 3 August, 1895, lat. 17° 51.8′ S., long. 179° 12.7′ E., 650 fathoms.

PTEROPOD OOZE, fawn colour. The deposit was formed into lumps in the bottle.

CALCIUM CARBONATE [80%], Pteropods, pelagic and bottom-living Foraminifera, otoliths, Ostracodes, Echini spines, coccoliths, rhabdoliths, Tunicate spicules.

RESIDUE [20%]

Minerals [3%], pumice and other volcanic particles.

Siliceous Organisms [3%], Sponge spicules, Radiolaria, Diatoms, arenaceous Foraminifera.

Fine Washings [14%], amorphous clayey matter and minute mineral particles.

H.M.S. "Penguin," Sounding 69, 7 August, 1894, lat. 23° 30.3′ S., long. 153° 52.7′ E., 660 fathoms.

PTEROPOD OOZE, containing about 65 per cent. of carbonate of lime.

This deposit was received in two bottles marked respectively upper stratum and lower stratum. The upper stratum is darker in colour than the lower, being brownish grey, while the lower stratum in the bottle showed two layers (the lower quite bluish grey the upper light grey). The upper stratum contained many arenaceous Foraminifera (which were not observed in the lower stratum), and the Foraminiferous shells were coloured brown by managanese (of which there was no trace n the lower stratum).

H.M.S. "Penguin," Sounding 329, 20 August, 1895, lat. 14° 4.1′ S., long. 171° 49.5′ W., 1,027 fathoms.

PTEROPOD OOZE,

CALCIUM CARBONATE (70.3%), Pteropod fragments, pelagic and bottom-living Foraminifera, otoliths, amorphous calcareous matter.

RESIDUE (29.7%)

Minerals [2%], pumice and other volcanic particles.

Siliceous Organisms [10%], Sponge spicules, Radiolaria.

Fine Washings [17.7%], amorphous matter and minute mineral particles.

H.M.S. "Waterwitch," Sounding 131, 20 May, 1895, lat. 19° 9′ S., long. 77.° 52′ 40″ E., 1,102 fathoms.

PTEROPOD OOZE, of a light brown colour.

CALCIUM CARBONATE [40%], Pteropods, pelagic and bottom-living Foraminifera, Ostracodes, Echini spines, coccoliths, rhabdoliths, Tunicate spicules.

RESIDUE [60%], dark brown.

Minerals [20%], pumice, volcanic glass, mica.

Siliceous Organisms [3%], Sponge spicules, Radiolaria, arenaceous Foraminifera.

Fine Washings [37%], amorphous matter and minute mineral particles.

H.M.S. "Penguin," Sounding 236, 3 August, 1895, lat. 16° 45.5′ S., long. 179° 14.2′ W., 771 fathoms.

PTEROPOD OOZE, of a fawn colour.

CALCIUM CARBONATE [90%], Pteropods, pelagic and bottom-living Foraminifera, Ostracodes, Echini spines, Polyzoa, coccoliths, rhabdoliths, Tunicate spicules.

RESIDUE [10%], brown.

Minerals [1%], volcanic glass, pumice.

Siliceous Organisms [2%], Sponge spicules, Radiolaria, arenaceous Foraminifera.

Fine Washings [7%], amorphous matter and minute mineral particles.

H.M.S. "Penguin," Sounding 381, 30 December, 1895, lat. 28° 44.4′ S., long. 176° 4′ W., 5,147 fathoms.

RED CLAY (or Volcanic Mud), grey-brown, homogeneous, containing no carbonate of lime.

Minerals [40%], m.di. 0.08mm.; principally disintegrated pumice (the largest fragments 2mm. in diameter), much magnetite and palagonite, along with augite, hornblende, felspars.

Siliceous Organisms [1%], Radiolaria, arenaceous Foraminifera.

Fine Washings [59%], amorphous clayey matter with enormous numbers of minute particles of pumice and other unrecognisable minerals.

The upper layer of this deposit was examined separately, but no differences were observed that would alter the above determinations.

H.M.S. "Penguin," Sounding 383, 31 December, 1895, lat. 30° 27.7′ S., long. 176° 39′ W., 5,155 fathoms.

RED CLAY (or Volcanic Mud), light grey, containing a few gritty particles of pumice and of a greenish rock, the largest about 5mm. in diameter. No calcareous organisms, nor siliceous organisms, observed.

Minerals [40%], m.di. 0.1mm ; principally fragments of felspathic pumice, with a few fragments of augitic pumice, felspars, augite, hornblende (?), much magnetite, small fragments of a greenish coloured rock, and a few palagonitic particles.

Fine Washings [60%], amorphous clayey matter with minute indeterminable particles of minerals as enumerated above.

H.M.S. "Penguin," Sounding 377, 27 December, 1895, lat. 24° 5.8′ S., long. 174° 17.4′ W., 3,185 fathoms.

RED CLAY (or Volcanic Mud), uniform brown colour when wet, grey when dry, containing a few macroscopic pieces of pumice, the largest 2 to 3mm. in diameter. There was no effervescence when treated with dilute acid, but a fragment of a calcareous Foraminifera and a fragment of a fish's tooth were noticed among the washings.

Minerals [40%], m.di. 0.07mm. (excluding the larger fragments of pumice), angular and rounded ; principally grey felspathic pumice, augite, hornblende, much magnetite, palagonite.

Siliceous Organisms [4%], arenaceous Foraminifera, Sponge spicules, Radiolaria.

Fine Washings [56%], amorphous clayey matter with minute particles of pumice.

H.M.S. "Penguin," Sounding 379, 28 December, 1895, lat. 26° 43.2′ S., long. 175° 13.7′ W., 3,350 fathoms.

RED CLAY, grey-brown, homogeneous, containing no carbonate of lime ; showed dark lines, when the bottle was shaken, due to minute grains of magnetite about 0.02mm. in diameter.

Minerals [12%], m.di. 0.07mm., angular and rounded ; principally fragments of felspathic pumice, the largest about 1mm. in diameter, with many small fragments of magnetite.

Siliceous Organisms [2%], Radiolaria, Sponge spicules.

Fine Washings [86%], amorphous clayey matter and minute splinters of pumice.

H.M.S. "Penguin," Sounding 391, 3 January, 1896, lat. 33° 50′ S., long. 178° 49·5′ W., 3,037 fathoms.

RED CLAY, grey-brown, homogeneous, principally composed of comminuted fragments of pumice.

CALCIUM CARBONATE [1%], minute fragments of pelagic Foraminifera.

RESIDUE [99%],

Minerals [7%], m.di. 0.07mm., mostly elongated splinters of felspathic pumice.

Siliceous Organisms [10%], Radiolaria, Diatoms, arenaceous Foraminifera.

Fine Washings [82%], amorphous clayey matter with angular fragments of pumice.

H.M.S. "Penguin," Sounding 390, 3 January, 1896, lat. 32° 59.7′ S., long. 178° 11.9′ W., 3,071 fathoms.

RED CLAY, grey-brown, homogeneous, composed of broken-down pumice, the largest piece about 3mm. in diameter ; a macroscopic grain of manganese, about 2.5mm. in diameter, was also noticed.

CALCIUM CARBONATE [3%], pelagic Foraminifera, Echini spines.

RESIDUE [97%].

Minerals [10%], m.di. 0.08mm., angular and rounded ; felspathic pumice, much magnetite, palagonite.

Siliceous Organisms [3%], principally arenaceous Foraminifera, Radiolaria, Sponge spicules, Diatoms.

Fine Washings [84%], minute comminuted fragments of pumice and amorphous clayey matter.

H.M.S. "Penguin," Sounding 384, 1 January 1896, lat. 31° 15.3′ S., long. 177° 18.4′ W., 3,715 fathoms.

RED CLAY (or Volcanic Mud), light brown or fawn when wet, light grey when dry ; containing no carbonate of lime ; with many rounded fragments of pumice, the largest over 1cm. in diameter, having many crystals of felspars, augite and magnetite projecting from their surfaces.

Minerals [50%], m.di. 0.07mm. (excluding the larger fragments of pumice), angular and rounded ; principally grey felspathic pumice, much magnetite, augite, hornblende, palagonite.

Siliceous Organisms [2%], Radiolaria, Sponge spicules, and arenaceous Foraminifera.

Fine Washings [48%], much amorphous clayey matter, with minute fragments of pumice less than 0.05mm. in diameter, the greater part less than 0.02mm. in diameter.

H.M.S. "Egeria," Sounding 47, 10 August, 1889, lat. 7° 52′ S., long. 171° 1½′ W., 2,766 fathoms.

RED CLAY, dark brown or chocolate colour ; slightly gritty due to pumice fragments and grains of manganese, the largest about 2mm. in diameter. There was no effervescence with dilute acid, but a few frag-

ments of pelagic Foraminifera and of fishes teeth were noticed.

Minerals [20%], m.di. 0.1mm., rounded; principally pumice fragments and manganese grains.

Siliceous Organisms [3%], Sponge spicules, Radiolaria, Diatoms.

Fine Washings [77%], amorphous clayey matter, with minute mineral particles and manganese grains.

U.S.S. "Enterprise," lat 47° 8′ S., long. 168°W., 2,972 fathoms.

RED CLAY, of a grey colour, containing no carbonate of lime.

Minerals [3%], pumice, glassy particles, manganese.

Siliceous Organisms [2%], Sponge spicules, Radiolaria, Diatoms.

Fine Washings [95%], amorphous clayey matter and minute mineral particles.

Other two soundings in the same neighbourhood, viz., lat. 46° 36′ S., long. 172° 34′ W., 2,782 fathoms, and lat. 48° 16′ S., long. 160° 17′ W., 2,533 fathoms, were similar in composition to the foregoing.

U.S.S. "Enterprise," lat. 45° 45′ S., long. 176° 37′ W., 2,180 fathoms.

RED CLAY, light grey when dry, dark grey when wet.

CALCIUM CARBONATE [20%], pelagic and bottom-living Foraminifera (mostly fragmentary), coccoliths.

RESIDUE (80%]

Minerals [1%], pumice and glassy particles.

Siliceous Organisms [2%], Radiolaria, Sponge spicules.

Fine Washings [77%], minute mineral particles and amorphous clayey matter.

U.S.S. "Enterprise," lat. 47° 22′ S., long. 164° 34′ W., 2,793 fathoms.

RED CLAY, brownish grey, containing no carbonate of lime.

Minerals [20%], pumice, rounded grains of quartz, manganese grains, greenish and yellowish minerals; piece of dark brown rock 0.5cm. in diameter.

Siliceous Organisms [1%], Sponge spicules.

Fine Washings [79%], minute mineral particles and amorphous clayey matter.

Another sounding (lat. 47° 54′ S., long. 162° 22′ W.), 2,750 fathoms, was quite similar to the above, but with apparently fewer mineral particles (probably about 10 per cent.).

U.S.S. "Enterprise," lat. 45° 52′ S., long. 166° 46′ W., 2,881 fathoms.

RED CLAY, brownish grey, containing the merest trace of carbonate of lime due to a few minute fragments of pelagic Foraminifera.

Minerals [3%], pumice (half-a-dozen particles 0.5 to 0.8mm. in diameter), and a few quartz grains.

Siliceous Organisms [1%], Spicules of Radiolaria and Sponges.

Fine Washings [96%], disintegrated pumice and amorphous clayey matter.

H.M.S. "Penguin," Sounding 331, 20 August, 1895, lat. 14° 49.4′ S, long. 171° 51.9′ W., 2,532 fathoms.

RED CLAY (or Volcanic Mud), of a brown colour.

CALCIUM CARBONATE [5%], small pelagic Foraminifera.

RESIDUE [95%], brown.

Minerals [50%], principally small particles of pumice.

Siliceous Organisms [10%], Radiolaria (including Challengeridæ), Sponge spicules, Diatoms.

Fine Washings [35%], amorphous matter and minute mineral particles.

H.M.S. "Penguin," Sounding 330, 20 August, 1895, lat. 14° 32′ 21″ S., long. 172° 2′ 42″ W., 2,622 fathoms.

RED CLAY, brown in colour, with only a trace of carbonate of lime.

Minerals [10%], m.di. 0.08mm., minute particles of pumice and other volcanic minerals, some altered, palagonite.

Siliceous Organisms [5%], Sponge spicules, Radiolaria (including Challengeridæ), Diatoms.

Fine Washings [85%], amorphous clayey matter and minute mineral particles.

H.M.S. "Penguin," Sounding 333, 21 August, 1895, lat. 15° 32′ 28″ S., long. 172° 3′ 32″ W., 3,532 fathoms.

RED CLAY (or Volcanic Mud), brown in colour, containing no carbonate of lime. Some of the deposit was coagulated into a lump.

Minerals [30%], small particles of pumice and other volcanic material.

Siliceous Organisms [3%], Sponge spicules, Radiolaria, Diatoms.

Fine Washings [67%], amorphous clayey matter and minute mineral particles.

H.M.S. "Penguin," Sounding 326, 19 August, 1895, lat. 14° 44.8′ S., long. 173° 37.1′ W., 2,634 fathoms.

VOLCANIC MUD (or Red Clay), containing no carbonate of lime.

Minerals [80%], volcanic rock fragments (max. diameter 0.7mm.) and augitic pumice (maximum diameter 1mm.) in abundance.

Siliceous Organisms [1%], Sponge spicules.

Fine Washings [19%], amorphous matter and fine mineral particles.

H.M.S. "Waterwitch," Sounding 134, 21 May, 1895, lat. 18° 27′ 10″ S., long. 178° 27′ E., 1,130, fathoms.

VOLCANIC MUD, brown, clayey.

Calcium carbonate [40%], pelagic and bottom-living Foraminifera, Pteropod fragments, Echini spines, otoliths, Coral fragments, coccoliths, rhabdoliths, Tunicate spicules.

Residue [60%]

Minerals [20%], olivine, mica, pumice, manganese grains, volcanic glass.

Siliceous Organisms [2%], Sponge spicules, arenaceous Foraminifera, imperfect casts.

Fine Washings [38%], amorphous clayey matter and minute mineral particles.

H.M.S. "Waterwitch," Sounding 135, 21 May, 1895, lat. 18° 18′ 50″ S., long. 178° 24′ 45″ E. 795 fathoms.

VOLCANIC MUD, brown, clayey.

Calcium carbonate [25%], pelagic and bottom living Foraminifera, Pteropod fragments, otoliths, Ostracodes, coccoliths, rhabdoliths, Tunicate spicules. Some of the shells coloured brown or black by manganese.

Residue [75%]

Minerals [10%], pumice, mica, olivine.

Siliceous Organisms [5%], Sponge spicules, Radiolaria, arenaceous Foraminifera, imperfect casts.

Fine Washings [60%], amorphous clayey matter and small mineral particles.

H.M.S. "Penguin," Sounding 336, 22 August, 1895, lat. 16° 28.8′ S., long. 173° 1.4′ W., 1,611 fathoms.

VOLCANIC MUD, grey-brown in colour.

Calcium carbonate [10%], pelagic and bottom living Foraminifera (with many young forms), coccoliths.

Residue [90%]

Minerals [60%], principally pumice particles, the largest 3.5mm. in diameter.

Siliceous Organisms [3%], Sponge spicules, Radiolaria, and Diatoms.

Fine Washings [27%], amorphous clayey matter and minute mineral particles.

H.M S. "Penguin," Sounding 335, 21 August, 1895, lat. 15° 52′ 54″ S., long. 172° 36′ 49″ W., 2,427 fathoms.

VOLCANIC MUD, brown, containing grey clayey lumps.

Calcium carbonate [15%], pelagic Foraminifera, coccoliths (numerous and large), and minute Tunicate spicules.

Residue [85%]

Minerals [40%], volcanic material ranging from pieces of volcanic rock (mostly unaltered) 2 to 3mm. in diameter down to the merest pumice fragments.

Siliceous Organisms [3%], Radiolaria (including Challengeridæ), Sponge spicules.

Fine Washings [42%], amorphous matter and small mineral particles.

The clayey lumps in this deposit were lighter in colour, chalky and white when dry, containing probably 10 to 20 per cent. more carbonate of lime than the looser matrix, the constituent particles being on the whole smaller, the largest mineral particles not exceeding 0.5mm. in diameter; otherwise no distinction can be drawn between the deposit itself and the enclosed aggregations.

H.M.S. "Penguin," Sounding 226, 1 August, 1895, lat. 19°24′ 14″ S., long. 176° 19′ 19″ W., 1,275 fathoms.

This position is about 80 miles N.W. of Falcon Island and the deposit might equally well be called Volcanic Mud or Globigerina Ooze.

GLOBIGERINA OOZE (or Volcanic Mud), brown in colour.

Calcium carbonate (33.5%), pelagic and bottom-living Foraminifera with many young forms, Echini spines, coccoliths, rhabdoliths, and amorphous calcareous matter.

Residue (66.5%), dark brown.

Minerals [7%], principally pumice, the largest fragments about 3mm. in diameter.

Siliceous Organisms [2%], Sponge spicules, Radiolaria, Diatoms.

Fine Washings [57.5%], minute pumice particles and amorphous clayey matter.

H.M.S. "Penguin," Sounding 225, 1 August, 1895, lat. 19° 51.9′ S., long. 175 55.1′ W., 1,397 fathoms.

This position is about 40 miles N.W. of Falcon Island, and the deposit is largely composed of pumice and other volcanic material derived probably from the disintegration of that island.

VOLCANIC MUD, dark brown in colour.

Calcium carbonate [5%], pelagic Foraminifera mostly young forms, coccoliths, rhabdoliths.

Residue [95%], dark brown.

Minerals [60%], m.di 0.1mm., chiefly pumice (both felspathic and augitic), the largest fragments about 1.5mm. in diameter, obsidian, palagonite, felspar.

Siliceous Organisms [1%], Sponge spicules, Radiolaria.

Fine Washings [34%], minute mineral particles and amorphous matter.

H.M.S. "Waterwitch," Sounding 136, 21 May, 1895, lat. 18° 12′ 40″ S., long. 178° 24′ 30″ E., 302 fathoms.

VOLCANIC MUD, of a greenish colour. There were indications of two layers in the bottle, the upper of a brown colour.

Calcium carbonate [35%], pelagic and bottom-living Foraminifera, Pteropod fragments,

small Lamellibranch shells, Echini spines, Ostracodes, coccoliths, rhabdoliths, Tunicate spicules.

RESIDUE [65%]

Mineral [10%], m.di. 0.07mm., pumice and other volcanic particles. One piece of pumice 2mm. in diameter observed, but the minerals are mostly of small size.

Siliceous Organisms [3%], Sponge spicules, arenaceous Foraminifera.

Fine Washings [52%], many minute mineral particles and amorphous matter.

H.M.S. "Penguin," Sounding 266, 11 August, 1895, lat. 15° 55′ 13″ S., long. 177° 35′ 41″ W., 1,432 fathoms.

GLOBIGERINA OOZE, of a dark brown colour.

CALCIUM CARBONATE (51.8%), principally pelagic Foraminifera with a very large proportion of young forms.

RESIDUE (48.2%), black-brown.

Minerals [3%], principally pumice (one piece 2mm. in diameter observed), manganese grains.

Siliceous Organisms [3%], Radiolaria (including young Challengeria), Sponge spicules, and Diatoms.

Fine Washings [42·2%], principally pumice in a state of fine division, with minute grains of manganese and amorphous matter.

H.M.S. "Penguin," Sounding 325, 18 August, 1895, lat. 15° 5.6′ S., long. 174° 20′ W., 1,362 fathoms.

VOLCANIC MUD, of a brown colour.

CALCIUM CARBONATE [20%], pelagic and bottom-living Foraminifera with many young forms, coccoliths, rhabdoliths.

RESIDUE [80%]

Minerals [30%], fragments of pumice, the largest 2 to 3mm. in diameter.

Siliceous Organisms [3%], Sponge spicules, Radiolaria, Diatoms.

Fine Washings [47%], amorphous matter and minute particles of pumice.

H.M.S. "Penguin," Sounding 327, 19 August, 1895, lat. 14° 28′24″ S., long. 172° 48′ 22″ W., 2,835 fathoms.

Fragments of volcanic rock and volcanic glass largely converted into palagonite and coated with manganese: some of the fragments 0.5cm. in diameter.

H.M.S. "Penguin," Sounding 328, 20 August, 1895, lat. 14° 12.2′ S., long. 172° 11.1′ W., 2,128 fathoms.

VOLCANIC MUD,

CALCIUM CARBONATE [30%], pelagic Foraminifera, Coral fragments, coccoliths, rhabdoliths.

RESIDUE [70%]

Minerals [30%], principally pumice.

Siliceous Organisms [3%], Sponge spicules, Radiolaria.

Fine Washings [37%], minute mineral particles and amorphous matter.

H.M.S. "Penguin," Sounding 342, 23 August, 1895, lat. 18° 22·7′ S., long. 173° 50.3′ W., 1,141 fathoms.

VOLCANIC MUD, brownish grey colour.

CALCIUM CARBONATE [20%], pelagic and bottom-living Foraminifera (many young), Ostracodes, coccoliths, rhabdoliths, Tunicate spicules.

RESIDUE [80%],

Minerals [60%], m.di. 0.2mm., principally black volcanic glass and pumice, the largest particles 3.5mm. in diameter, palagonite.

Siliceous Organisms [2%], Sponge spicules, Radiolaria.

Fine Washings [18%], amorphous clayey matter and minute fragments of pumice.

U.S.S. "Enterprise," lat. 44° 41′ S., long. 178° 53′ W., 751 fathoms.

GREEN SAND (or Green Mud), light grey in colour, fine grained.

CALCIUM CARBONATE [25%], pelagic and bottom-living Foraminifera, Echini spines, coccoliths (some very large), and small Holothurian spicules.

RESIDUE [75%]

Minerals [40%], pumice, glassy particles, quartz, glauconite, mica.

Siliceous Organisms [1%], Sponge spicules.

Fine Washings [34%], amorphous matter and fine mineral particles.

Another sounding by the "Enterprise," near Chatham Is. (lat. 44° 8′ S., long. 178° 57′ W.), 184 fathoms, indicated a Green Sand, but the very small quantity of material had the appearance of having been washed; the carbonate of lime did not apparently exceed 10 per cent., the remainder being principally mineral particles (glauconite, glauconitic casts, quartz, &c.)

U.S.S. "Enterprise," lat. 42° 27′ S., long. 175° 34′ E., 1,192 fathoms.

BLUE MUD, of a greenish colour, fine grained.

CALCIUM CARBONATE [15%], pelagic and bottom-living Foraminifera, Echini spines, coccoliths (some very large).

RESIDUE [85%]

Minerals [10%], quartz, glauconite, glassy particles.

Siliceous Organisms [1%], Sponge spicules, Diatoms.

Fine Washings [74%], amorphous matter and fine mineral particles.

Another sounding by the "Enterprise," about midway between New Zealand and Chatham Is. (lat. 42° 7′ S., long. 178° 19′ E.), 1,320 fathoms, was similar to the foregoing, but appeared to have fewer mineral particles (probably about 5%).

PROCEEDINGS

OF THE

Royal Geographical Society of Australasia,

QUEENSLAND.

Twenty-first Anniversary Celebration—1885-1906.

The celebrations arranged in commemoration of the Twenty-first Anniversary of the foundation of the Royal Geographical Society of Australasia, Queensland were inaugurated at 11 o'clock a.m., on Tuesday, June 26, 1906, when his Worship the Mayor of Brisbane, Alderman John Crase, held an Official Reception at the Town Hall in honour of the occasion. There was a large attendance of members of the Society and other representative citizens, including the Hon. A. Morgan (President of the Legislative Council), the Hon. A. J. Carter, M.L.C., the Hon. F. T. Brentnall, M.L.C., the Hon. E. J. Stevens, M.L.C., the Hon. A. Norton, M.L.C., his Honour Mr. Justice Real, the Hon R. Philp, M.L.A., Messrs. J. Cameron, J. Stodart, J. Leahy, J. Forsyth, MM.L.A., the Right Rev. James M'Queen, the Rev. Loyal L. Wirt, B.D., the Mayor of South Brisbane (Alderman Burton), Aldermen Mills, M'Master, Rankin, Fleming, Jackson, Davies, Thompson, Wilson, Buchanan, and Down, Lieutenant-Colonel Irving, Dr. Eleanor Greenham, the Misses M'Clymont (2), Messrs. J. H. Strong (representing the Education Department of New South Wales), L. A. Bernays, C.M.G., G. H. Buzacott, L. F. Schoenheimer, A. M. Hertzberg, G. Phillips, R. Fraser, E. J. T. Barton, C. W. Costin, A. D. Walsh, A. Muir, R. Cliff Mackie, B. W. Macdonald, J. G. Macdonald, F.R.G.S., J. D. Guard, W. W. Hood, T. Mylne, P. W. Crowe, W. C. Gregory, S. W. Brooks, and Dr. James P. Thomson (Hon. Secretary and Treasurer).

After receiving his guests the Mayor delivered an address dealing with the Economic Aspects of Geography (see page 21).

Hon. A. Morgan, M.L.C., said that in the absence of his Excellency, the President of the society, he desired, on behalf of the Council and the members of the society, to thank the Mayor for his invitation to the representatives of kindred societies to be present on this occasion. He desired also to acknowledge the interest which his worship had taken in the movement for the celebration of the anniversary of the society—an interest strikingly evinced in the excellent paper which he had taken the trouble to read and prepare for them. He trusted that the interest which was shown by the Mayor and by the public of Brisbane in the work that the society had done and was doing would have its effect in furthering that work, for the society existed, not for the glorification of the officers and members, but for the good that it could do—and undoubtedly the society had done a great deal of good in a quiet way, and was capable of doing a great deal more in the future. (Hear, hear.) To that end, however, they required the

sympathy and support of the citizens, not only of Brisbane, but of the State generally. Personally, as an officer of the society, he felt very much indebted to the Mayor for all that he had done. He would have been exceedingly glad to have seen a large number of visiting delegates present, and it would certainly have afforded the society great pleasure to endeavour to make their stay pleasant. He hoped that those who had come would enjoy their visit.

Mr. John Cameron, M.L.A., endorsed the remarks which had fallen from Mr. Morgan. He desired to thank the Mayor for the very able paper that he had read, and for the unwavering interest he had displayed, not only in this society, but in everything that was for the benefit of the community.

Hon. F. T. Brentnall, M.L.C., said he felt scarcely equal to speaking on the spur of the moment on a paper such as this. The subjects with which the Mayor had dealt were too deep to be lightly touched upon, and the paper as a whole was one upon which much thought and labour must have been bestowed. It was due to the Mayor to express their due appreciation of the pains that he had been at in the preparation and production of such an elaborate discourse.

Dr. Jas. P. Thomson also joined in expressing the high appreciation which the society felt of the interest which the Mayor had taken in their anniversary celebrations, and in the praise which had been given of his very able speech.

The thanks of the assemblage having been signified by acclamation the proceedings terminated.

MAYORAL LUNCHEON.

The Mayor, in continuation of his hospitable recognition of the society's anniversary, afterwards entertained a large company at luncheon at the Brisbane Club. There were present—the Hon. W. Kidston (Premier), the Hon. A. H. Barlow (Minister for Public Instruction), the Hon. J. T. Bell (Minister for Lands), the Hon.T. O'Sullivan (Minister for Public Works), the Hon. A. Morgan (President of the Legislative Council), the Hons. A. J. Carter, E. J. Stevens, F. T. Brentnall, MM.L.C., the Hon. R. Philp, M.L.A., Messrs. J. Leahy, J. Cameron, J. Stodart, MM.L.A., Alderman R. E. Burton (Mayor of South Brisbane), Aldermen M'Master, Wilson, Buchanan, Thompson, Fleming, Hetherington, Mills, Rankin, Down, Lieutenant-Colonel Irving, the Rev. Loyal L. Wirt, B.D., Messrs. A. M. Hertzberg, C. H. Buzacott, R. Fraser, H. J. Diddams, W. Morse, A. Midson, W. V. Ralston, T. J. O'Shea, A. Muir, S. W. Brooks, J. Chapman, J. H. Strong, A. S. Kennedy, R. C. Mackie, G. Phillips, L. F. Schoenheimer, and Dr. James Park Thomson. Apologies were received from the Hon. the Chief Justice, the Speaker (Sir A. Cowley), the Attorney-General (the Hon. J. W. Blair), the Home Secretary (the Hon. P. Airey), the Railway Commissioner (Mr. J. F. Thallon), the Hon. E. B. Forrest, the Hon. P. Murphy, the Commissioner of Police (Major Cahill), the Commander H.M.S. Torch, the Naval Commandant (Captain Tickell), Messrs. G. H. Woolnough, J. Maxwell, H. J. Browne, and E. Denny Day. The chair was occupied by the Mayor, and the vice-chair by Alderman Burton.

An excellent luncheon having been discussed, the Mayor proposed the toasts of "The King" and of "His Excellency the Governor,' which were suitably honoured.

Hon. F. T. Brentnall, M,L.C., then proposed the toast of "The Royal Geographical Society of Australasia, Queensland." In doing so, he felicitated the Hon. Secretary (Dr. Jas. P. Thomson), on the coming of age of the society. Dr. Thomson had really brought it into existence,

and he had fostered it with almost paternal care, and conducted its affairs with indefatigable enthusiasm. They were much indebted to the Mayor for the kindly hospitality and the generosity with which he had inaugurated their celebrations. He was glad to see that the Mayor recognised that there were some things in our industrial, social, and scientific world worthy of recognition besides tennis players, footballers, and cricketers. He did not think the Mayor in any degree lowered, but rather he thought he added to the lustre of the traditions of his high office, when he gave this formal and handsome recognition of the twenty first anniversary of the foundation of this society. He (Mr. Brentnall) took it that if an association of this kind was to make itself felt and be of real benefit to the community, it must have some underlying principle of utility. He did not think any one would deny that the study of geography expanded the mind as well as enlarged the knowledge of the student—and whether they considered the intellectual, the scientific, or the industrial side, if that study was earnestly and faithfully carried out it promoted the welfare of the community. It was the navigating geographers of earlier days that had opened the world to commerce, and the world owed a deep debt to those navigators, who in their vessels of 300 or 400 tons had prosecuted the work of discovery. They could only hope that the society would have a wider influence and a larger accession of members.

Hon. A. Morgan, M.L.C., in responding, said that the idea of celebrating the twenty-first anniversary of the society had originated with the Hon. Secretary. One could only deeply deplore that the late President had not lived to be present at the celebrations that day. There was no doubt that the Geographical Society had done a great deal of good work for Queensland.

Mr. A. M. Hertzberg proposed the toast of the "Queensland Ministry." He took it that the present Ministry represented the majority, and as such were entitled to their respect and sympathy in their efforts to do the best for the community at large. He thought they had been successful in the task they had undertaken, and that they had done exceedingly good work in the interests of the State.

Hon. Wm. Kidston, M.L.A., in responding, said he did not quite see the connection between the Ministry and the Geographical Society in this matter. He could not help thinking, this being the twenty-first anniversary of the foundation of the Geographical Society, that it was a great pity that it was not started earlier, so that the earliest Governments of Queensland might have known something of the geography of their country. He did not think the first Governments knew very much about the geography of Queensland. He knew, of course, that it was quite unnecessary for him to say anything on behalf of the present Ministry. They knew what had taken place in recent years, and their appreciation of the actions of the Ministry was quite sufficient without any words of his on the subject at all. Besides he did not think this was a good place to talk about the business of Government and Parliament—those matters would be settled a little later, perhaps. The faults or the virtues of the Government were not a matter of very much concern on the present occasion, and this was not a good time to make speeches, when most of those present, like himself, wanted to get back to their business.

Lieutenant-Colonel Irving proposed "The Queensland Parliament."

Mr. John Cameron, M.L.A., in responding, complimented Dr. J. P. Thomson on the excellent work that he had done as Secretary of the society. There was no doubt that if it had not been for Dr. Thomson and his unwavering exertions, there possibly would not have been any Geographical Society here at all. He thought they were bound to give him credit for that, and for his indefatigable efforts. He had much pleasure in proposing the health of "Dr. James Park Thomson, as the Founder of the Royal Geographical Society of Australasia, Queensland."

The toast was received with great enthusiasm and accorded musical honours.

Dr. Thomson, in returning thanks, said he was deeply sensible of the compliment they had been pleased to pay him and he could assure them that in the work of the Geographical Society two objects had been in view. One was to further the objects for which the society existed, and the other was to further the interests of the country to which they all belonged. Those two objects he would pursue, as long as he was able to, in the interests of the country and of the society.

Mr. John Leahy, M.L.A., proposed the health of "The Mayor," and, in doing so, complimented him upon the excellent and admirable paper that he had read at the reception. That paper showed that he was a man of high mental calibre—that he was a man who dealt much in speculative thought, and had the power and the faculty of putting what he wished to say in excellent words. He (the Mayor) had done himself honour in honouring the Geographical Society as he had done.

The Mayor briefly returned thanks and the proceedings terminated.

EVENING MEETING.

In the evening the celebrations were continued at the Rooms of the Society, Public Library Building.

The visitors of previous years were delighted to find that a new and convenient staircase had been erected, and other improvements made, besides charming decorations of ferns, greenery, and flags for the occasion. The decorations and nicely-appointed tables, loaded with dainty refreshments, were arranged by a sub-committee of ladies, which included Mesdames J. Cameron, A. M. Hertzberg, A. S. Kennedy, G. Fox, Walter Gregory, J. Stodart, L. F. Schoenheimer, and J. P. Thomson.

His Excellency the Rt. Hon. Lord Chelmsford, K.C.M.G., President of the Society, received the members and their friends, who on entering the Rooms were introduced by the Hon. Arthur Morgan, M.L.C., Vice-President, and Dr J. P. Thomson, Hon. Secretary and Treasurer. His Excellency the Governor was accompanied by Lady Chelmsford, Miss Du Cane, and Capt. Newton, A.D.C. The attendance was very large and representative.

In opening the proceedings the President extended a cordial welcome to the representatives of kindred bodies and local institutions.

The following representatives responded and conveyed hearty congratulations to the Society on the attainment of its majority.—Mr. J. H. Strong, representing the Department of Public Instruction, New South Wales ; Hon. A. J. Carter, representing the Brisbane Chamber of Commerce ; Mr. H. J. Diddams, representing the Chamber of Manufactures ; Dr. A. J. Turner, representing the Royal Society of Queensland ; and Dr. J. P. Thomson, representing the Man-

chester Geographical Society, and the Sociedad Cientifica, "Antonio Alzate," Mexico. Congratulatory messages were then presented as follows :—

Royal Geographical Society,

"1, Savile Row, Burlington Gardens, London, W.

"December 11th, 1905.

"Dr. J. P. Thomson,

"R. Geographical Society.

"Dear Dr. Thomson,—Your circular of October 28th., with reference to the 21st anniversary of the foundation of the Queensland Society has been placed before the Council. They desire me to convey to the Society their warmest congratulations on having attained its majority. They recognise that it has been one of the most active of the branches of the Australasian group of Societies ; that it has done much excellent work, much of it due to your zeal and activity. They wish the Society every success in the future, and that it may grow in numbers and in usefulness.

"I am afraid it will not be possible to send anyone from the Mother Country to represent this Society on the occasion of the forth-coming celebration, but it is hoped that we may be able to obtain the services of one of our fellows, resident in Australia. . . . . .

"Yours very truly,

J. S. KELTIE."

"Sociedad Mexicana de Geografia y Estadistica,

"Mexico.

"Esta Sociedad ha recibido el atento oficio por el que se ha servido ud. invitarla para la celebracion del 21o aniversario de la fundacion de la Honorable Real Sociedad Geografica de Australasia, y siente mucho que no le sea posible hacerse representar en una fiesta tan grata como memorable para sus dignos miembros.

"Por lo mismo acordó esta Sociedad que se exprese por el presente oficio, como tengo la honra de hacerlo, que agradece mucho esa invitacion y que desea los mayores progresos en el campo de la ciencia a esa Honorable Sociedad Geográfica.

"Protesto a Ud. mi distinguida consideracion y respeto.

"Mexico, 8 de Mayo de 1906,

ALEJANDRO PIRETO.

"Sr. Presidente de la Sociedad Real de Geografia de Australasia, Queensland."

"The American Geographical Society,

"No. 15 West 81st Street, New York,

"February 12, 1906.

"Dear Sir,—The Council of this Society has received with pleasure your communication with the printed date of October 23, 1905,announcing the purpose of your Society to commemorate in June of this year the close of the first 21 years of the active life of the Royal Geographical Society of Australasia Queensland.

"While it will not be possible for this Society to be represented at your celebration I am instructed to convey to you our heartiest congratulations and to assure you that we appreciate the valuable work already accomplished by your

Society, and look forward with entire confidence to a future yet more worthily distinguished in the broad field of usefulness before you.

" With high regard and esteem,

" Very truly yours,

" GEO. C. HURLBUT,

" Acting Secretary.

" J. P. Thomson, LL.D., F.R.S.G.S., &c.,
" Hon. Secretary and Treasurer,
" Royal Geographical Society of Australasia,
" Brisbane, Queensland."

" k.k. Geographische Gesellschaft in Wien,

" Wien, am 30 Marz, 1906.

" An
" die Royal Geographical Society of Australasia,
" Brisbane,
" Queensland.

" Die k.k. Geographische Gesellschaft in Wien sendet ihre herzlichsten Glückwunsche zum 21 Stiftungsfest der Gesellschaft und hofft auf deren ferneres Blühen und Gedeihen.

" Mit vorzüglichster Hochachtung,

" Das Präsidium der k.k. Geographischen Gesellschaft,

" Der Prasident :

" DR. EMIL TIETRE.

" Der General Sekretar,

" J. GALLINE."

" Real Sociedad Geografica, Madrid.

" A la Royal Georgaphical Society of Australasia, en el vigésimo primer año de su fundacion, envia cordialísimo saludo la Real Sociedad Geografica.

" Ruego a V.S., Sr. Secretario y distinguido colega, que se sirva transmitir a sus consocios este nuestro saludo en el solemne acto de la conmemoracion del aniversario.

" Madrid, 15 Abril, 1906.

" El Secretario general,

" RICARDO BELTRAN Y ROZPIDE.

" Al Sr. J. P. Thomson, Secretario de la Real Sociedad Geografica
" de Australasia."

" Det kongelige danske geografiske Selskab.

" Kobenhavn den 28/5, 1906.

" Gentlemen,—" Det kongelige danske geografiske Selskab " thanks you very much for the kind invitation to assist at the celebration of the 21st Anniversary of the Foundation of " The Royal Geographical Society of Australasia."

" We indeed very much regret that we are not able to send any delegate owing to the great distance between our Societies, but we herewith take the opportunity to congratulate your Society most heartily.

" On behalf of the Council,

" O. OLUFFIN,

" Secretary.

' To The Royal Geographical Society of Australasia, Queensland."

"Württ. Verein für Handelsgeographie,
"Stuttgart, den 22 Dezember, 1905.

"Sehr geehrte Herren,--Im Auftrag des Ausschusses meiner Gesellschaft habe ich die Ehre, für die mit Schreiben vom 23 Oktober ds, Js. an uns ergangene Einladung zur Teilnahme an der Feier der 21. Wiederkehr des Gründungsfestes Ihrer Gesellschaft den ganz ergenbensten Dank auszusprechen. Sollte sich die erwünschte Gelegenheit ergeben, ein Mitglied unserer Gesellschaft mit deren Vertretung bei der Feier betrauen zu können, so würden wir mit grossem Vergnügen Ihrer freundlichen Aufforderung folgen ; schon jetzt aber sendet der Ausschuss meiner Gesellschaft den aufrichtigsten Wunsch für einen glänzenden Verlauf Ihrer Feier.

"Hochachtungsvoll,
"Der Vorstand.
"GRAF LINDSEE."

"Royal Scottish Geographical Society,
"Queen Street, Edinburgh,
"10 January, 1906.

"To the Council of the Royal Geographical Society of Australasia,
"Queensland.

"Gentlemen,—Your kind letter of invitation was brought before the Council of this Society at their meeting yesterday, and I was desired to thank you very much for the most cordial invitation which you have extended to them to take part in the celebrations of the Twenty-first Anniversary of the Foundation of your Society, in the last week of June 1906, and to inform you that they esteem the honour very highly.

"They regret, however, that for the moment there does not appear to be any probability of one of their number being able to represent the Royal Scottish Geographical Society on the auspicious occasion of your Commemoration Ceremonial, but they hope to be able to intimate to you later that they have arranged to be fitly represented either by one of themselves, or perhaps by a member of this Socety in Australasia.

"I am,
"Yours faithfully,
"W. LACHLAN FORBES, "Secretary."

"Manchester, 19th March, 1906.

"Dear Sir,—The Council of the Manchester Geographical Society have asked me to thank you for the information you have kindly sent them of the 21st Anniversary of the Foundation of the R.G.S. of Australasia being about to be celebrated in the last week of June, and for the invitation you have sent inviting our Society to be represented at the Function.

"I regret that no active member of our body is likely to be in Brisbane at the date you name, but the Council will be very grateful to you, if you will add to the services you have already conferred upon us, by accepting the duty of representing our Society and expressing our good wishes for the prosperity of the Royal G.S. of Australasia, and our hearty congratulations on its past success and usefulness.

"I have the honour,
"Dear Sir, to be yours faithfully,
"S. ALFRED STEINTHEL,
"Chairman of the Council of the
"Manchester Geographical Society."

To Dr. J. P, Thomsom.

" Royal Geographical Society of Australasia,
" South Australian Branch,
" Adelaide, 20th June, 1906.

" The Right Hon. Lord Chelmsford,
" President of the Royal Geographical Society,
" Brisbane, Queensland.

" Your Excellency,—I very much regret that this Society cannot be represented at the celebration of the 21st anniversary of the Foundation of your Society. It was hoped that some members might be able to be present, but unfortunately no member of the Council finds it possible to attend.

" I desire on behalf of the members of this Society to congratulate you and your members most heartily on the celebration of such an interesting event in the history of your branch, and also on the successful work that has been accomplished during its existence. Your Society, from its inception, has shown an enthusiastic interest in geographical matters and the activity it has manifested in the promotion of geographical knowledge and science has been greatly appreciated by us as members of a kindred body. The manner in which the interest and strength of your Society has been maintained has been very gratifying to us.

" You have adopted a fitting method of commemorating the attainment of your 21st year and I congratulate you on the excellent programme that has been arranged. I sincerely hope that your meetings will be attended by the success they so warmly merit, and that in the future your work may be as successful as in the past.

" I am, Sir,
" Yours sincerely,
" J. Langdon Bonython, President."

" Queen's University,
" Kingston, Ont., 18th May, 1906.

" Dear Dr. Thomson,—I have to acknowledge the receipt of your kind invitation of 5th ult. extended to the Senate of Queen's University to send a representative to the celebration of the twenty-first anniversary of the foundation of the Royal Geographical Society of Australasia.

" I regret that, as your celebration is appointed for the last week of June prox., it will not be possible for us to send a representative, but on behalf of the Senate of Queen's University I wish to express our appreciation of the work done by your Society, and our desire that it may be able to continue and extend that work not only for the welfare of Australasia, but for the general increase of knowledge and the benefit of mankind.

" Believe me,
" Yours very faithfully,
"Daniel M. Gordon.

" James P. Thomson, Esq., LL.D.,
" Brisbane, Queensland."

" The Manchester Literary and Philosophical Society,
" Instituted Feby. 1781.
" 36 George Street, Manchester, May 22nd, 1906.

" J. P. Thomson, Esq.,
" Hon. Secretary and Treasurer,
" Royal Geographical Society of Australasia,

" Dear Sir,—I am instructed by the Council of this Society to express their regret that they are unable to send a delegate to represent them at the forthcoming

celebration of the Twenty-first Anniversary of the Foundation of the Royal Geographical Society of Australasia, but have much pleasure in forwarding the accompanying congratuatory letter, signed by the President and Secretaries, to be read at the celebration.

"I am,
"Yours truly,
"A. P. Hunt,
"Asst. Secy."

"The Manchester Literary and Philosophical Society,
"Instituted Feby. 1781.
'36 George Street, Manchester, May 18th, 1906.

"The Council of the Manchester Literary and Philosophical Society desires to congratulate the Royal Geographical Society of Australasia on the occasion of the celebration of the Twenty-First Anniversary of its Foundation, and wishes to express the hope that the Society, which has done so much to advance the progress of natural science in the past, may long continue to carry on its successful work.

"W. H. Bailey,
'President.
"Francis Jones,
"F. W. Gamble,
"Honorary Secretaries."

'Koninklijke Akademie van Wetenschappen te Amsterdam,
"Amsterdam, 10 January, 1906.

"Dear Sir,—I have the honor, by direction of the members of the Roya Academy of Sciences, Amsterdam, to offer their cordial congratulations to the Royal Geographical Society of Australasia (Queensland), on occasion of the celebration of the Twenty-First Anniversary of its Foundation.

"The Dutch Academy, being unable to send delegates to the celebration in the last week of June, 1906, rejoices however with your Society on the happy completion of the first twenty-one years of its history, a history of illustrious service in the advancement of Geographical Sciences and I beg to express the earnest hope that the prosperity and the high distinction, that have been attained by your Society in the past years, in the future will be mantained and perpetuated.

"I am,
"Yours faithfully,
"J. D'Udwaals, Secretary."
"Royal Academy of Sciences.

"To the Hon. Secretary of the
"R. Geographical Soc. of Australasia (Queensland),
"Brisbane."

"Royal Meteorological Society,
"Princes Mansions,
"70 Victoria Street, S.W., April 30, 1906.

"To the Hon. Secretary and Hon. Treasurer of
The Royal Geographical Society of Australasia (Queensland).

"Dear Sir,—I beg to acknowledge on behalf of the Council and Fellows of the Royal Meteorological Society the invitation to take part in the Proceedings at Brisbane for the celebration of the Twenty-first Anniversary of the establishment of your Society.

"It was intended, in response to your kind request, that one of our Fellows distinguished for his services to meteorology should have represented this Society, on the occasion of the commemoration in question, but I regret to learn that he is prevented by the state of his health from being present.

Under these circumstances it is the wish of the Royal Meteorological Society that I should convey to you, as its spokesman, our cordial appreciation of the invitation you have done us the honour of sending from so great a distance, and also to ask you to give our very hearty congratulations to the President, officers, and Council, and the Fellows of the Royal Geographical Society of Australasia (Queensland) on its coming of age—and our best wishes for many future years of useful work.

"I remain, dear Sir,
"Yours very truly,
"RICHARD BENTLEY,
("President of the Royal Meteorological Society.")

'Zoological Society of London
"3 Hanover Square,
"London, W, January 20, 1906.

"J. P. Thomson, Esq., LL.D., etc., etc.,
"Hon. Secretary and Treasurer,
"Royal Geographical Society of Australia, Brisbane,

"Dear Sir,—I am requested by the Council of this Society to thank you for your letter of Oct. 23 and to say in reply that we have asked Professor Baldwin Spencer, C.M.G., F.R.S., Corresponding Member of this Society, to represent us at your approaching celebration and to convey to the Royal Geographical Society of Australia the congratulations of the Zoological Society of London.

"I am,
"dear Sir,
"Yours very faithfully,
"P. CHALMERS MITCHELL,
"Secretary and Member of Council."

"Smithsonian Institution,
"Washington, January 18, 1906.

"The Secretary of the Smithsonian Institution has the honor to acknowledge the receipt of the invitation of the Royal Geographical Society of Australasia to take part in the celebration of the twenty-first anniversary of its Foundation, during the last week in June, 1906.

"While the Secretary regrets that it is not practicable for him to name a delegate on behalf of the Institution to attend this interesting commemorative ceremonial, he begs leave to express the most cordial good wishes for the continued prosperity of this successful and honored Society.

"The Royal Geographical Society of Australasia,
"Through Doctor J. P. Thomson,
"Honorary Secretary and Treasurer.

"American Academy of Arts and Sciences,
"Boston, Massachusetts, March 13, 1906.

"To J. P. Thomson, Esq.,
"Hon. Secretary and Treasurer of the
"Royal Geographical Society of Australasia,

'Dear Sir,—Your invitation to the Council of the American Academy of Arts and Sciences to be represented at the coming celebration of the Twenty-first

Anniversary of the Foundation of the Royal Geographical Society of Australasia was duly received and laid before the American Academy at its last meeting, though I am as yet unable to say positively whether this Academy will be able to accept the invitation thus extended, I desire in the name of the American Academy to thank you for the courtesy of the invitation and to express the wish that the Society which you represent will flourish with all the vigor which appears to be a general characteristic of institutions in your part of the world.

' Very truly yours,

" EDWIN H. HALL,

" Corresponding Secretary."

" The Academy of Science of St. Louis.

" St. Louis, Mo., Feb. 11th, '06.

" J. P. Thomson,

" Hon. Secretary and Treasurer,

" Royal Geographical Society of Australasia,

" Queensland, Brisbane.

" Dear Sir,—The Council of the Academy of Science of St. Louis is pleased to have received an invitation to take part in the celebration of the twenty-first anniversary of the foundation of your Society. It desires to offer its congratulations to your past success and its best wishes to your continued welfare.

" Yours very respectfully,

" H. AUG. HUNICKE,

" Corresp. Secy."

" Wisconsin Academy of Sciences, Arts, and Letters,

" Office of the Secretary,

" Madison, Wis., Feb. 10, 1906.

" To the Royal Geographical Society of Australasia,

" Queensland.

" The Wisconsin Academy of Sciences, Arts, and Letters thanks the Royal Geographical Society of Australasia for its courtesy in extending an invitation to take part in the celebration commemoration of the completion of the first twenty-one years of the active life of your Society and regrets that by reason of the great distance separating us it will not be possible for us to be represented.

" Hoping that the next twenty-one years of your life may be even more prosperous than the years that are past and that your excellent work may go on without hindrance, I am,

" Very respectfully yours,

" E. B. SKINNER."

" Colorado Scientific Society,

" Denver, Colorado,

" Chamber of Commerce Building,

" February 12, 1906.

" J. P. Thomson,

" Hon. Secretary and Treasurer,

" Royal Geographical Society of Australasia,

" Queensland.

" Dear Sir,—On behalf of this Society, I beg to acknowledge the receipt of your kind invitation to be represented at the celebration of the 21st anniversary of the foundation of your Society, to be held at Brisbane the last week of June,

1906. At our last regular meeting on February 3rd, a resolution was passed requesting Mr. Robt. Sticht, of Queenstown, Tasmania, to be present as our representative at your meeting.

" Yours very respectfully,

" W. H. Johnston,

" Secretary."

" Sociedad Cientifica " Antonio Alzate."

" Mexico, le 26 Février, 1906.

" J. P. Thomson, LL.D., &c.,

" Hon. Secretary and Treasurer,

" Royal Geographical Society of Australasia,

" Brisbane.

"Trés honoré Monsieur et confrere,—Cette Société a eu l'honneur de recevoir votre circulaire en date 23 Octobre, 1905, par laquelle vous voulez bien lui annoncer que votre Société commémorera le mois de Juin prochain le 21me. anniversaire de sa fondation, et aussi vous le fait l'honneur de l'inviter à se faire representer dans la célebration solennelle à cet occasion.

" La Société m'a chargé de vous témoigner sa profonde reconnaissance et de vous annoncer qu'elle a l'honneur de vous prier de vouloir bien accepter vous meme la representation de la Société " Alzate " dans le 21me. anniversaire de votre Société, en lui exprimant toutes ses plus vives félicitations et en lui souhaitant les meilleurs et plus hauts progres. Elle ne peut faire mieux que se faire representer par un savant qui comme vous a contribue en si grande echelle au develloppement de la Géographie chez vous, et qui dans maints fois a témoigné à la Société " Alzate " sa sympathie.

" Veuillez agréer, tres honoré confrere, l'assurance de ma plus haute considération.

" Le Secretaire perpétuel,

" R. Aguilar."

" Appalachian Mountain Club,

" Office of Corresponding Secretary and Librarian,

" 1050 Tremont Building, Boston, Feb. 15, 1906.

" J. P. Thomson, Esq.,

" Hon. Secretary and Treasurer,

" Royal Geog. Soc. of Australasia,

" Brisbane, Queensland,

" Dear Sir,—Your communication of October 23 has only just been called to my attention. On behalf of the Council of our Club I congratulate the Royal Geographical Society of Australasia on attaining its majority and regret that distance forbids our accepting your cordial invitation to take part in its commemoration. We hope and trust that the next twenty-one years of your society's life may be as prosperous as the past has been. The extent of your continent, so largely unexplored, offers an ample field for your energies which I doubt not will be fully improved.

" Yours very truly,

" Gardner M. Jones,

" Corresponding Secretary."

"The Royal Society of New South Wales,
"The Society's House,
"5 Elizabeth St., N., 21 June, 1906.

"To Dr. J. Park Thomson, F.R.G.S., &c.,
"Hon. Secretary and Treasurer,
"Royal Geographical Society of Australasia,
"Queensland.

"Dear Sir,—Referring to previous correspondence and to your kind invitation to the Royal Society of New South Wales to participate in the 21st Anniversary Celebration of your Society, to take place on the 26, 27, 28, and 29, of this month, I beg to inform you that the Council, at its last meeting, unanimously appointed Mr. Lewis A. Bernays, C.M.G., F.L.S., one of our oldest Honorary Members (and a resident in your City) to represent the Royal Society of N.S.W. at the forthcoming celebration.

"I sincerely regret that through a strange inadvertence this letter has been delayed so long, but trust it will reach you in time, also that Mr. Bernays—who has been notified—will be able to act on our behalf, and that the function will be eminently successful.

"I am, Dear Sir,
"Yours faithfully,
"J. H. Maiden,
"per W.H.H., Hon. Secretary."

"Linnean Society of New South Wales,
"23 Ithaca Road, Elizabeth Bay,
"Sydney, June 1st, 1906.

"James Park Thomson, Esq.,
"LL.D., etc.,

"Dear Sir,—I am directed by my Council to thank the Royal Geographical Society of Australia, Queensland for its kindness in inviting the Linnean Society of N.S.Wales to participate in the celebrations associated with the attainment of its majority.

"The Society is unfortunately unable to send one of its Council as a representative but although absent in the body it will be present in the spirit, and while wishing your Society every good wish upon the eventful day, it feels sure that the celebration is only one of the links in a long chain of similar events.

"I am, dear Sir,
"Yours faithfully,
"R. Greig-Smith, D.Sc., Acting Secretary."

"N.Z. Institute, Colonial Museum,
"Wellington, New Zealand, Feb. 24th, 1906.

"J. P. Thomson, Esq.,
"Hon. Sec Royal Geog. Society of Australia,
"Queensland.

"Sir,—On January 26th I wrote thanking you for your invitation of Oct. 23, and stating that this Institute would be represented if possible. I desire now to say that Professor Liversidge of Sydney University, an hon, member of the N.Z. Institute has been asked to act as our representative, if he is to be present on that occasion.

"Yours obediently,
"Thos. H. Gill, Secretary."

"Palestine Exploration Fund,
"Sutherland, N.S.W. June 25th, 1906.

"The Secretary,
"Royal Geographical Society of Australasia,
"Queensland.

"Dear Sir,—On behalf of the 'Palestine Exploration Fund,' I desire to congratulate the Royal Geographical Society of Australasia, Queensland on the accession to its Twenty-first Anniversary, and trust that the celebrations connected therewith will tend to deepen its usefulness, and invoke more sympathy in Geographical Research generally.

"Yours fraternally,
"W. P. F. Dorph,
"Secretary for N.S.W.,
"Palestine Exploration Fund."

"Department of Mines and Water Supply,
"Melbourne, 23rd May, 1906.

"Sir,—I beg to acknowledge the receipt of your circular invitation bearing date 25th October last, addressed to The Chief, Geological Survey Department, Melbourne, to the celebration of the Twenty-First Anniversary of the Foundation of the Royal Geographical Society of Australasia, Queensland, and to inform you in reply, that it is regretted that the Director cannot personally attend, but he desires to express the wish that the anniversary may be a thorough success and that the Society may continue to flourish.

"I have the honour to be, Sir,
"Your most obedient servant,
"P. Cohen,
"Secretary for Mines and Water Supply.
"Per J.W.

"J. P. Thomson, Esq., LL.D., Hon. F.R.G.S., &c.,
"Hon. Secretary and Treasurer,
"Royal Geographical Society of Australasia,
"Brisbane, Queensland."

CABLEGRAM.

From His Excellency the Right Hon. Lord Lamington, G.C.M.G., Governor of Bombay.

"Station from : Ganeshkhind, 6.40 p. 26th.

"Addressed to the Hon. Secretary, Royal Geographical Society of Australasia, Brisbane.

"'Hearty Congratulations'
"'Lamington.'"

CABLEGRAM.

From His Excellency the Hon. W. L. Allardyce, C.M.G., Governor of the Falkland Islands.

"Station from : Montevideo. 11.30 a.m. 25th.

Addressed to Dr. J. P. Thomson, Royal Geographical Society of Australasia, Brisbane.

"'Hearty congratulations on the Twenty-first Anniversary of the Foundation of our Society."

"Allardyce."

"The Governor of Bombay.

"10th Jan. 1906.

"Dear Dr. Thomson,—I am very pleased to know that the Queensland Branch of the R.G.S. of Australasia continues its work as vigorously as of old. No doubt your zealous care of its interests is largely responsible for its growth.

"Excellent proof is given of the success that the Society has achieved by he fact that its Members desire to celebrate its "Coming of Age." No doubt the thought present is that they intend to mark its entrance into a life of even wider research and utility.

"I recall with cherished memories the many evenings that I spent in the Rooms listening to instructive addresses.

"I wish you all success in your Commemoration and I shall be glad to learn in what form it takes place.

"I regret to say that Lady Lamington is and has been for a long time seriously ill. I remember how Lady Lamington often accompanied me to geographical meetings, as I hope you do.

"With kind regards,

"I am,

"Yours truly,

"LAMINGTON."

"5th February, 1906,

"Newstead Abbey, Nottingham.

"Dear Dr. Thomson,—I am much obliged for and interested in your communication concerning the Anniversary of the Foundation of Queensland branch of the R. Geog. Soc., and hope that the ceremonial celebration will be in all respects successful. In Anthropology, and Ethnology, as well as in Geography, especially its physical branch, there is wide scope for the mental activities of Australasians. The interesting narrations at your Maryborough Conference served to emphasize the importance of accurate record of early settlement and exploration—in the historical section. . . . . .With kind regards to Mrs. Thomson and yourself,

"Yours very truly,

"HERBERT CHERMSIDE."

"Kilmorie, Colinton Road, Edinburgh,

"26th. Dec., '05.

"Dear Sir,—Had it been at all possible for me to visit Australia it would, I am sure, have given me great pleasure to accept your Council's most kind invitation to take part in the celebration of the 21st anniversary of your Society's foundation. But I must forego that pleasure and ask you to excuse me. . . . I sincerely hope your Celebration will in every way be successful.

"Believe me,

"Yours very truly,

"JAMES GEIKIE."

"British Rainfall,

"Symons's Meteorological Magazine,

"62, Camden Square, London, N.W.,

"6th December, 1905.

"Dear Dr. Thomson,—I am interested in hearing of the proposed celebration of the coming of age of your society and I wish that it were possible for me to take part in it personally, but distance forbids. . . . . .

"Wishing you the greatest success for the celebration and with kind regards from Mrs. Mill and myself.

"Yours very sincerely,
"HUGH ROBERT MILL."

"The London School of Economics and Political Science,
"Clare Market, London, W.C.
"7th March, 1906.

"Dear Dr. Thomson,—. . . . . I will, if possible, send you the paper that you desire, but owing to various causes I am very busy this Spring, and you must not calculate too certainly on receiving it.

"With kind regards, and best wishes for the success of your Celebration.

"Believe me,
"Yours very truly,
"H. J. MACKINDER."

"Mr. H. C. Russell . . . . . . congratulates the R.G. Society of Aus. on attaining its majority and hopes that the functions connected with the Celebration may be most successful.

"The Observatory,
"Sydney, New South Wales, "May 15th, 1906."

"The Chemical Laboratory,
"The University of Sydney, N.S.W.,
"The Hon. Sec., "May 29th, 1906.
"R. Geog. Soc. of Australasia,
"Brisbane.

"Dear Sir,—I am sorry that I am unable to have the pleasure of accepting the kind invitation of the Royal Geographical Society of Australasia to attend the celebration of the 21st Anniversary of its Foundation. My duties at the University render it impossible for me to leave Sydney at that time.

"Please accept my most cordial congratulations upon the success of the Society and my best wishes for its continued prosperity.

"I am,
"Yours truly,
"A. LIVERSIDGE."

"Penghana, Queenstown,
"June 19th, 1906.

"James Park Thomson, Esq.,
"Hon. Sec. Royal Geogr. Soc. Australasia,

"Dear Sir,—I beg to advise, with sincere regret, that my engagements have not permitted me to avail myself of the opportunity of participating in the forthcoming celebration of the 21st anniversary of the Royal Geographical Society of Australasia, Queensland, as the representative of the Colorado Scientific Society, at Brisbane next week.

"May I ask you kindly to give expression to my apologies for unavoidable absence to the Members of the Society in the name of the Colorado Scientific Society, and to offer that body's most cordial good wishes for the success of the meeting and fraternal congratulations on the anniversary of the foundation of the Royal Geographical Society.

"I have the honour to be, Sir,
"Faithfully yours,
"ROBT. STICHT."

NEW MEMBERS.

The following were elected Members of the Society :—Hon. W. Kidston, M.L.A., (Premier), Dr. F. Woolrabe, and Mr. A. J. Patterson.

HISTORICAL REVIEW.

Dr. J. P. Thomson, Hon. Secretary and Treasurer of the Society, then delivered an address reviewing the work of the Society (see page 27).

VOTE OF THANKS.

The Hon. Arthur Morgan, M.L.C., Vice-President, moved a vote of thanks to Dr. Thomson for his extremely interesting address, which, he said, was an eloquent tribute to the work that was being done by the society.

His Excellency the President seconded the motion. This was the first occasion, he said, on which he had been present at a meeting of the society, and he was bound to confess that the high standard of strenuous effort set up by Dr. Thomson, not only for himself but for other members, rather appalled him. He would like to make a suggestion with regard to the work of the society. He realised all the work that had been done, but there were one or two little things which it might accomplish. For instance, when he went to Toowoomba last summer there were no names on the streets, and he found it difficult to discover a house which he wished to find. He would suggest that the society might deal with that question of geography in our country towns. Then in Brisbane he had several times attempted to get a map of Brisbane, but he had not been successful. "These," he concluded, "are only as it were two pins, but the elephant's trunk can pick up a pin as well as a beam of wood."

The motion was then carried by acclamation, and Dr. Thomson briefly returned thanks.

PRESENTATION OF THE SOCIETY'S THOMSON FOUNDATION GOLD MEDAL.

His Excellency the President presented the Society's Thomson Foundation Gold Medal, which had been awarded to the late Sir Hugh M. Nelson, prior to his death "For valuable services rendered to the Society," to Lady Nelson.

As the recipient rose to receive the medal from Lord Chelmsford, she was cordially greeted, the presentation being one of the most interesting and affecting incidents of the celebrations.

Mr. W. M. Nelson, in returning thanks on behalf of his mother, assured the society that the handsome gold medal which they had awarded to his late father, and which Lord Chelmsford had presented to his mother, would always be prized by the family, not only as a memento of the occasion, but also a tangible and lasting testimony of the sympathy which the members of the society had always extended to his father. He need scarcely say that his father had always had the best interests of the society at heart. His interest had been prompted, not only by a sense of public duty, but by the genuine interest he took in geographical research and the spread of geographical knowledge. In conclusion, he thanked the society for the graceful tribute they had paid to his father's memory.

FELLOWSHIPS.

Dr. Thomson moved that Lady Nelson should be elected an Honorary Member of the society, and that in accordance with Sub-section (b) of Section IV., clause 3 of the Constitution and Rules, the society's diploma of fellowship should be conferred on :—Dr. Hon. C. F. Marks, Mr. J. R. Atkinson, L.S., Hon.

A. Morgan, M.L.C., Mr. J. Stodart, M.L.A., Mr. L. F. Schoenheimer, and the Hon. F. T. Brentnall, M.L.C.

Lieutenant-Colonel James Irving seconded the motion, which was carried.

His Excellency the President then presented the diplomas to the gentlemen named.

This concluded the business part of the proceedings and the first day of the celebrations.

RIVER EXCURSION.

At 2 p.m. on the following day, Wednesday, the 27th, the celebrations were continued and assumed the form of a River Excursion in the Government steam yacht "Lucinda," kindly placed at the disposal of the Society by the Honourable the Chief Secretary. Perfect weather conditions rendered the excursion both pleasant and enjoyable. Duke Stewart's band discoursed choice selections of music during the afternoon. Dainty refreshments, arranged by the Ladies' Sub-committee, were served at intervals. A large number of the members of the Society and their friends took advantage of the outing. At the gangway the guests were received by the Hon. Arthur Morgan and Mrs. Morgan, and Dr. J. P. Thomson.

After a smart run down the river the "Lucinda" returned to the Queen's Wharf shortly after 4 o'clock.

In the evening the Society reassembled at the Rooms, where the attendance, as formerly, was large and representative. The Hon. Arthur Morgan, M.L.C., and Vice-President of the Society, presided.

Mesdames W. Menzies and A. Parr-Smith were elected Members of the Society on the nomination of Dr. J. P. Thomson and Lieut.-Col. James Irving, respectively.

Mr. John Cameron, M.L.A., read a paper on "The Present Problems of Geography," by Dr. H. R. Mill (see page 43).

Dr. J. P. Thomson moved a vote of thanks to the author of the paper, who was a personal friend of his own, and a fellow worker, and to Mr. Cameron for reading the paper. Dr. Mill was one of the most active of all British geographers, and his reputation was world-wide. The British Rainfall Organisation, of which he was director, was a well-known institution, and it occupied the unique position of being entirely supported by voluntary contributions. It had a large number of co-operators and issued monthly one of the most valuable meteorological magazines in the English language. Prior to taking the directorate Dr. Mill occupied the position of Librarian to the Royal Geographical Society of London. He had brought the work of the organisation to a high degree of perfection, and he was regarded as perhaps the greatest authority on the scientific work with which it was identified.

Mr. E. C. Barton, in seconding the motion, said the chief thing in the paper which had struck him was the indication it gave of the large area of country that there was for them to take up. He was astonished to find what work there was to be done in geography before the science even got out of its infancy. He could not help thinking when reference was made to what had been done in Arctic and Antarctic exploration that much better results could be obtained from investigating the bed of the sea than from the exploration of the poles. The configuration of the bottom of the sea was practically unknown, and yet it was very important that we should know something about the submarine ranges of mountains, because he believed that would throw a lot of light on the formation of the earth. They wanted not only a survey of the earth, but of the bed of the ocean, the cav-

ities in the earth, and a survey of the sky. But the great thing in the paper was that it called attention to the fact that they could do a great deal of work and do it locally, and he thought it ought to be an object of a Society such as this to promote study by suggestion among the young, and encourage the making of observations and the collection of data. He for one believed that the rainfall of this country would to some extent be brought under control within the next fifty years ; and that we would be able to appreciably increase the rainfall in drought years. There was nothing chimerical about that ; it only needed observations to be made and data co-ordinated by a brain of the Farraday type to bring the matter to fruition. They could not all go to the North Pole or the South Pole, but they could all do useful work, where they were, and that was a truth which they should seek to impress on the minds of young men of scientific tendencies.

The vote of thanks was carried, and Mr. Cameron having briefly returned thanks, the proceedings terminated.

GARDEN PARTY AT GOVERNMENT HOUSE.

In the following afternoon (Thursday, 28) the Society was entertained by His Excellency the Governor and Lady Chelmsford at a Garden Party at Government House, specially arranged in Commemoration of its Twenty-first Anniversary. By the kindly and courteous consideration of the hosts the members of the Society were invited to " bring their wives and families to the Garden Party." The gathering was in consequence exceptionally large and representative.

The delightful weather, more like spring than midwinter, added to the general enjoyment. The Moreton Regimental Headquarters Band discoursed a well chosen programme of music throughout the afternoon, and refreshments were served from buffets on the verandas. His Excellency and Lady Chelmsford received their guests at the entrance to the tennis lawn, Captain Brooke, A.D.C., announcing the names. Captain Newton, private secretary, was also in attendance, and after the majority of the guests had arrived, Lady Chelmsford was joined by her children.

The kind attention bestowed upon the guests by Lord and Lady Chelmsford was greatly appreciated by all, rendering the entertainment one of the most pleasant and enjoyable features of the celebrations.

In the evening the Society again reassembled at the Rooms. His Excellency the President occupied the chair. The attendance was very large, and besides the usual number of ladies, included Members of the East Moreton Teachers' Association, who had been specially invited to hear Professor Richard Elwood Dodge's paper on " The Opportunity of the Geographer in Promoting School Geography " (see page 61).

The paper was read by Mr. George Phillips, C.E.

The discourse was listened to with much interest, and its close was marked by applause.

His Excellency, in moving a vote of thanks to Professor Dodge, said he had had an opportunity of reading the paper beforehand, and he had found it an extremely difficult paper to follow for the first time. With regard to the reference to the teacher as " her," to which the reader had alluded, his Excellency remarked that more and more the female was ousting the male sex in the teaching profession in America. He did not know if it was going to be so here. He was struck with the paper, because of the self-denying attitude the professor took up as a geographer in the case of teaching. The professor's motto was one that ought to be adopted here in the teaching of geography—namely, " Ars est celare

artem." Geography ought to be taught in the guise of some other subject, such as history. It was more likely to be learned in this way than under the guise of geography. Another point that came out very strongly was that the teacher of geography must possess the scientific spirit. Professor Dodge showed that it was quite impossible for the child of 13 to attempt the science of geography. His Excellency was inclined to think that in modern educational methods, we were apt to argue that what appealed to the adult appealed necessarily to the child. Teachers should be very careful in that respect. Putting one's self in the position of a child, he was sure one would approach geography as a very dry and nauseous subject, if Dr. Thomson would pardon him for saying so. The real benefit to be aimed at was to get into one's head a certain skeleton, in the various compartments of which could be put one's geographical knowledge. A child could not always reason. Its faculties must be brought out, and it must be taught dogmatically that a thing was so, and it would try to remember it. If one tried to teach a child to reason, one would very often fail, and so with regard to history. His Excellency had known a good many eminent historians in England, and he had heard them boast that they did not know a date, but the ordinary person found dates very useful things. They knew the dates of the reigns of the Kings and Queens of England—or they did know them once—and they were able to fix thereby any particular events in history. To the historian, who argued back from a consequence to a cause, no doubt dates were trifles. If possible, he repeated, geography should be taught through some such subject as history. For instance, if one remembered the Anjou kings, they might be remembered as kings more of a region in France than as kings of England. King Richard Coeur de Lion did not spend more than six months of his reign in England, he having been, during almost the whole of his reign, either in Palestine or the French dominions. Professor Freeman, in his book on historical geography, had a most clear series of maps, by which one might see how the boundaries of nations in Europe and elsewhere had altered from time to time. That was one of the means by which one should teach children geography. Mr. Phillips, during his reading of the paper, had in dealing with the dangers of the definition given to a river, pointed out that he had ridden 150 miles in the dry bed of a river. Well, a question that might be asked, in describing an Australian river was, When is a river not a river ? He thought the answer was that very river that Mr. Phillips rode down. If one tried to argue thus, one would find the children riding down a river, when they found they could. Faulty definitions led to most absurd mistakes. They probably all remembered that definition of the Equator by a schoolboy. He was taught that it was an imaginary line running round the centre of the earth, but when he had to put it on paper he described it as a " menagerie lion running round the centre of the earth." That child did not learn much from that intelligent definition. Intelligence should be put into the teaching of geography and definitions. His Excellency was glad to notice one caution that the professor put into his paper. That was the great tendency on the part of the untrained teacher to become too formal. He did hope that in Queensland there would be training of teachers. He believed there was a movement in that direction. He felt that when we had all these young people to bring up, it was perfectly useless to spend a large amount of money on their teaching, however worthy the objects, and however devoted to the teachers might be, unless an opportunity was afforded the teachers of learning the particular line which they had to teach. When

we had trained teachers, as he believed we would have, the teachings of geography should be one of the things in which they were trained.

Mr. John Leahy seconded the motion, and said he agreed with His Excellency that the paper was a most involved one. But they were indebted to the professor for its being involved, inasmuch as it had led to his Excellency delivering an excellent speech, which would do more to further the teaching of geography than the reading of the paper could. The professor was a perfect master of geography, but he was not a Macaulay in composition, although the paper undoubtedly was a valuable one. The society was to be congratulated on having as president a gentleman of such expert knowledge of geography as his Excellency.

The vote was carried with acclamation.

Mr. Phillips, in acknowledging it, suggested that the paper should be printed and distributed to teachers.

Mr. R. Cliffe Mackie, speaking of the definition of a river, said the only rivers in Australia that ran into the sea were the coastal rivers.

SUPPER AND CONVERSAZIONE.

On the following evening the celebrations were brought to a close by a supper and conversazione at the Cafe Eschenhagen.

Lieut.-Col. James Irving, M.R.C.V.S., presided, and there was a large and representative attendance, including a great number of ladies.

Dr. J. P. Thomson presented a paper "On the Depth, Temperature, and Marine Deposits of the South Pacific Ocean," by Sir John Murray, K.C.B., LL.D., D.Sc., F.R.S. (see page 71). Dr. Thomson explained that the paper had come to hand just in time for the concluding part of the celebrations. He moved that it be taken as read. The motion was seconded by Mr. John Cameron, M.L.A., supported by Mr. Robert Fraser, and carried unanimously. In moving the vote of thanks to the author Dr. Thomson said that the paper was a most valuable and important contribution to geographical literature, and a monumental memoir on the subject with which it deals. Sir John Murray was the eminent British scientist who had completed the famous "Challenger Reports." He had rendered great and lasting services to Geography and was perhaps the greatest oceanographer of the age. The society was greatly honoured by Sir John Murray's communication, which was a monument of wide research and deep investigation.

The motion was carried by acclamation.

On the motion of Dr. Thomson, seconded by the Chairman, and supported by Mr. Robert Fraser, the cordial thanks of the Society were voted to :—"His Worship the Mayor of Brisbane," for his interest in the celebrations ; "The "Queensland Government," for use of "Lucinda" ; "His Excellency the Governor and Lady Chelmsford," for graceful hospitality ; "The Ladies Refreshment Sub-Committee—Mesdames John Cameron, George Fox, Walter C. Gregory, A. M. Hertzberg, A. S. Kennedy, L. F. Schoenheimer, James Stodart, J. P. Thomson," for services rendered during the celebrations ; to "Mr. James Stodart, M.L.A.," for special contribution to refreshments on board "Lucinda," and to all who have contributed in money or in kind towards the expenses of the celebrations, as follows :—

	£	s.	d.		£	s.	d.
Mrs. Arthur Morgan	2	2	0	Mrs. P. P. Outridge ..	1	1	0
Mrs. Jas. A. Foot	2	0	0	Mrs. W. J. Scott	1	1	0
Mrs. John Leahy	2	0	0	Mrs. W. C. Gregory ..	1	1	0

	£	s.	d.		£	s.	d.
Mr. and Mrs. J. J. McIver	1	1	0	Mrs. T. B. Cribb	0	10	6
Mrs. T. Mylne	1	1	0	Mrs. J. P. Thomson ..	0	10	6
Mrs. R. M. Collins	1	1	0	Mrs. J. Archibald ..	0	10	6
Mrs. R. H. Hillcot ..	1	1	0	Mrs. P. W. Crowe ..	0	10	6
Lieut.-Col. James Irving ..	1	1	0	Lady Nelson	0	10	6
Mrs. A. S. Kennedy ..	1	1	0	Mrs. E. W. Walker ..	0	10	0
Mrs. W. F. Taylor.. ..	1	1	0	Mrs. R. H. Mathews ..	0	10	0
Mrs. A. M. Hertzberg ..	1	1	0	Mrs. W. B. Slade ..	0	10	0
Mrs. J. Stodart	1	1	0	Mrs. C. B. Lethem ..	0	10	0
Mrs. C. F. Marks	1	1	0	Mrs. R. Cliffe Mackie ..	0	10	0
Mrs. J. Cameron	1	1	0	Miss McClymont ..	0	10	0
Mrs. L. F. Schoenheimer ..	1	1	0	Mrs. George Phillips ..	0	10	0
R. Fraser, Esq.	1	1	0	A. Muir, Esq.	0	10	0
Ald. John Crase, Mayor of Brisbane	1	1	0	A. H. Blackman, Esq. ..	0	5	0
				Mrs. Allan A. Spowers ..	0	5	0
Mrs. F. T. Brentnall ..	1	0	0	Thos. O'Connor, Esq. ..	0	5	0
Mrs. J. T. Bell	1	0	0	Mrs. A. C. Raff	0	5	0
Mrs. G. Fox	1	0	0	W. R. Parker, L.D.S. ..	0	5	0
Mrs. C. F. Plant	1	0	0	Mrs. Curtis	0	2	6
Mrs. W. A. Wilson ..	0	10	6	Interest on Banking Acc.	0	0	11
Mrs. W. C. Thomson ..	0	10	6				
Mr. and Mrs. Geo. Fish ..	0	10	6		£37	10	11

Mrs. J. R. Atkinson, Mrs. C. W. Costin, Mrs. E. Hirschfeld, (In Kind).

An impromptu programme of music was contributed by Miss Schoenheimer, A.T.C.L., who played a Chopin Ballade ; Mr. H. M. Trower sang " The Young Royalist," and " The Little Irish Girl " ; and Captain W. C. Thomson recited a thrilling incident of the sinking of H.M.S. Eurydice.

Supper was served on many little tables decorated with wattle and roses, and the gathering broke up at 10 p.m., after an enthusiastic vote of thanks to the Hon. Secretary, Dr. J. P. Thomson, and Mrs. Thomson, for the brilliant success of the celebrations.

The following is a statement of receipts and expenditure, as supplied by the Hon. Treasurer to the Ladies' Refreshment Sub-Committee :—

Receipts.	£	s.	d.	Expenditure.	£	s.	d.
Subscriptions as per list ..	37	10	11	Catering, E. Eschenhagen	17	11	11
				Cigars, Lucinda trip ..	0	18	0
				Printing—			
				Outridge P. Co. ..	5	13	0
				W. H. Wendt & Co. ..	0	6	6
				String band, Duke Stewart	3	3	0
				Cartage, Pot Plants, etc...	0	7	6
				Sundries for decoration ..	0	6	0
				Charwoman	0	15	0
				Postcards, postages & Exch.	0	16	6
					£29	17	5
				Balance in hand ..	7	13	6
	£37	10	11		£37	10	11

Miriam Hertzberg, Hon. Treasurer.

ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

REPORT OF COUNCIL.

The Council has the honour of submitting to fellow members the Twenty-first Annual Report on the operations of the Society during the preceding financial year, ending on the 30th June, 1906.

While it is satisfactory to note that the Membership Roll has been augmented by the addition of one Honorary Member and 35 ordinary Members, it is equally sad to allude to the losses sustained by the death of some of our most valued supporters and fellow workers. This is especially so with regard to the loss of our late President, Sir Hugh M. Nelson, who passed away peacefully at the beginning of this year, after a short illness, and whose death occasioned wide-spread sorrow and profound regret at the removal of one who for so many years had been identified with the public life of the State, and who had endeared himself to the Members of the Society by his enthusiasm, his wide sympathies and unaffected manner. Of others from amongst us who have gone the way of all flesh we mourn the loss of Mr. Allan B. Bright, of Charters Towers, Mr. E. R. Edkins, of Mount Cornish, Muttaburra, the Hon. John Ferguson, of Rockhampton, the Hon. T. Macdonald-Paterson, of Brisbane, and Mr. John Mathieson, General Manager of the Midland Railway, England (a Life Member).

The Essay dealing with the Geographical Distribution of Australian Minerals, of which mention was made in last Annual Report as having been received in competition for the Society's Thomson Foundation Medal was duly examined and adjudged as being worthy of a bronze impression of the Medal, which, however, was not accepted, and in deference to the wish of the author it was decided that the essay should not be printed. But the manuscript is retained amongst the records of the Society and may be consulted by any member interested. The succeeding literary competition on the Agricultural Industry of Australia closed on the 30th June last. For this one paper has been received and is now in the hands of a Committee of the Council for examination and report. In referring to these competitions it may be mentioned that in response to an application from the Women's Christian Temperance Union of Queensland it was decided to give as a prize a copy of Dr. J. P. Thomson's book "Round the World" for the best map of Queensland drawn in school, under the auspices of the Union. The successful competitor was Master Robert Ferguson, of the Brisbane Central State School whose map was very creditably drawn, as reported by the examiner.

The twentieth volume of the "Queensland Geographical Journal" was issued early last session to members and exchanges as formerly. The succeeding number is now in the printer's hands and will be brought out as soon as possible.

For the purpose of celebrating the Twenty-first Anniversary of the foundation of the Society, special arrangements were made and carried out during the last week in June, the proceedings being inaugurated by the Mayor of Brisbane on Tuesday, the 26th with an Official Reception at the Town Hall and Luncheon at the Brisbane Club. The celebrations were continued on the

following days and concluded on Friday, the 29th, with a supper and conversazione. A special feature of the movement was noticeable in the excellent papers contributed by Sir John Murray, Dr. Hugh Robert Mill and Professor Richard Elwood Dodge. Besides the evening meetings at the Rooms, His Excellency the Governor and Lady Chelmsford gave a delightful Garden Party at Government House in commemoration of the event, and there was a pleasant river excursion in the Government steam yacht " Lucinda." The whole arrangements were organised and carried out in the most complete and perfect order, and the celebrations from beginning to end were eminently successful.

With the view of recognising in some special manner the valuable services rendered to the Society by the late Sir Hugh M. Nelson, who for nearly seven years had so worthily occupied the position of President, the Council decided that he should be awarded the Thomson Foundation Gold Medal, in accordance with the regulations governing the award. As the decision had been come to some months before Sir Hugh Nelson's death, it was afterwards agreed that the original intention should be carried out, and advantage was accordingly taken of the opening of the recent anniversary celebrations to hand over the medal to Lady Nelson, who personally received it at the hands of the President. At the same time her Ladyship was presented with the Diploma of Honorary Membership.

The Diploma of Fellowship has also been awarded to the following gentlemen, under subsection (C) of section IV, Clause 3 of the Constitution and Rules: —The Honourable Arthur Morgan, M.L.C., the Honourable C. F. Marks, M.D., M.L.C., the Honourable F. T. Brentnall, M.L.C., John Cameron, Esq., M.L.A., James Stodart, Esq., M.L.A., J. R. Atkinson, Esq., L.S., J.P., and L. F. Schoenheimer, Esq., J.P.

The Council has pleasure in formally announcing the receipt of a most valuable and interesting gift from the Messrs. F. W. and W. C. Gregory, consisting of the instrumental equipment of their uncle and their father, the late Sir Augustus Charles and the Honourable Francis Thomas Gregory, who had used the instruments on their famous exploring expeditions in Australia. The gift also includes a good example of the well-known Gregory pack saddle and some firearms of a form now rarely used, but in splendid order. And these have no doubt done good service at a time when there was but little settlement and exploration was carried on at considerable personal risk and danger from the attacks of hostile native tribes.

The Council has pleasure in recommending: — (1) The appointment of His Excellency the President, the Vice-President, and the Hon. Secretary and Treasurer as Trustees of the Medal Fund, in succession to the late Sir Hugh Nelson and in accordance with the provisions of the rules for controlling such fund; (2) The suspension of so much of the Rules as provides for the payment of an entrance fee; (3) The appointment of Messrs. Alexander Muir and Robret Fraser as Hon. Councillors. The usual financial statement is hereto appended and this is followed by an abstract showing the condition of the Medal Fund, which in future will be submitted annually for the information of members.

BRISBANE, 27 AUGUST, 1906.

Statement Showing the Condition of the Thomson Foundation Medal Fund Trust Account.

(Trustees: The President, Vice-President, and Hon. Secretary and Treasurer.)

Brought forward from previous report in "Queensland Geographical Journal," Vol. XVII., p. 172	£201	8	6
Rt. Rev. Dr. Gerard Trower, Bishop of Likoma, Central Africa ..	5	0	0
Interest	25	3	5
Bal. in Govt. Savings Bank, 13th Aug., 1906	£231	11	11

The balance on hand requires to be increased by £68 8s. 1d. to provide the necessary funds, and it is hoped that this amount will soon be contributed by members and friends of the Society, by whose voluntary contributions the Fund was originally established and raised to its present state. All contributions will be cordially acknowleged and fully detailed in the "Journal."

ABSTRACT OF THE ACCOUNTS OF THE ROYAL GEOGRAPHICAL

From 1st July, 1905,

	£ s. d.	£ s. d.
Funds at close of last Account :—		
Balance in Govt. Savings Bank	51 16 5	
Balance in Royal Bank	34 2 8	
		85 19 1
Annual Subscriptions received	165 11 2	
Interest on Govt. Savings Bank Deposit	1 10 7	
		167 1 9
		£253 0 10

Examined with Bank Books Vouchers, &c., and found correct.

R. H. FRASER, *Hon. Auditor.*

August 10th 1906

SOCIETY OF AUSTRALASIA, QUEENSLAND.
to 30th June, 1906.

	£	s.	d.	£	s.	d.
Expenditure as per accounts :—						
Printing "Journal"	59	3	4			
Postage on "Journal"	5	13	11			
				64	17	3
Printing and posting notices for Monthly Meetings ..	11	17	10			
Hire of Lantern for Meetings	3	0	0			
Advertising	1	18	9			
Refreshments for Annual Meeting (1905)	3	0	0			
Lantern Slides for Meetings	2	8	0			
Monthly and other Meetings, Cleaning Rooms, hire of chairs, etc.	7	4	6			
Gas Account	0	19	5			
				30	8	6
General Printing (notifications to Members, etc.) and domestic and foreign postage	10	13	5			
Binding Library Copy of "Journal"	0	11	0			
Iron Safe	5	0	0			
Fire Insurance Premiums	2	16	3			
Engrossing Resolutions and Address	2	12	0			
Petty Cash	6	8	2			
Wreath and Funeral Expense	4	6	0			
Refunded Subscription	1	1	0			
Cartage and freight on books	1	11	2			
Typing	0	14	0			
Sub. to "Nature" and P.O.O.	1	11	6			
Exchanges on cheques and cheque book	0	19	6			
Bank Charges	0	10	0			
Sundry Expenses	2	2	6			
				40	16	6
				136	2	3
Balance in Royal Bank				63	11	7
Balance in Govt. Savings Bank				53	7	0
				£253	0	10

J. P. THOMSON, *Hon. Secretary and Treasurer.*

Royal Geographical Society of Australasia,

QUEENSLAND.

DIPLOMAS OF FELLOWSHIP.

The following gentlemen have been awarded the Diploma of Fellowship under Section IV. of Clause 3, Constitution and Rules (*See page 2 of Cover*) :–

Honorary:

His Excellency Sir William MacGregor, K.C.M.G., C.B., M.D., LL.D., D.Sc., Hon. F.R.S.G.S., etc.

The Right Hon. Lord Lamington, G.C.M.G., B.A., F.R.G.S., Hon F.R.S.G.S., etc.

Under subsections (a and b) :—

Lieut.-Col. James Irving, P.V.O., Q.D.F., M.R.C.V.S.L.
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Charles Battersby, Esq., J.P.
Robert Fraser, Esq., J.P.
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LIST OF MEMBERS.

P) Members who have contributed papers which are published in the Society's "Proceedings and Transactions." The numerals indicate the number of such contributions.

PP) Past President.

A dagger (†) prefixed to a name indicates a member of the Council.

Life members are distinguished thus (*).

Should any error or omission be found in this list, it is requested that notice thereof be given to the Hon. Secretary.

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P1 Atkinson, J. R., J.P., F.R.G.S.A.Q., Lic. Surveyor, Ipswich, Queensland.

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Honorary Corresponding Members

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John Tebbut, Esq., F.R.A.S., etc., etc., Private Observatory, "Peninsula," Windsor, N.S.W.

P2 H. R. Mill, Esq., LL.D., D.Sc., F.R.S.E., F.R.G.S., F.R.S.G.S., Director, British Rainfall Organisation, 62 Camden Square, London, N.W., England.

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P14 R. H. Mathews, L.S., Associé étranger Soc. d'Anthrop de Paris ; Corr. Memb. Anthrop. Soc., Washington ; Corr. Memb. Anthrop. Soc., Vienna ; "Carcuron," Hassall Street, Parramatta, N.S. Wales.

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Professor Richard Elwood Dodge, Teachers College, Columbia University, New York City, U.S.A.

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OUTRIDGE PRINTING CO., QUEEN ST., BRISBANE, QUEENSLAND.

The Royal Geographical Society of Australasia,

QUEENSLAND.

Conditions of Competition for The Thomson Foundation Gold Medal.

The Thomson Foundation Gold Medal of this Society will be awarded to the Author of the Best Original Paper (provided it be of sufficient merit) on each of the following subjects:—

To be sent in not later than 1st July, 1908.

1.—The Distribution and Economic Utility of the Artesian and Sub-Artesian Waters of Queensland.

To be sent in not later than 1st July, 1909.

2.—The Economic Utility and Distribution of the Sub-Marine Fauna of Queensland.

The competition is open to Members and Non-members of the Society alike, whether residing in Australasia or elsewhere, but not to any Officer of the Society or Member of the Council for the time being. No award of the Medal will be made for a mere compilation, no matter how meritorious.

All competitive communications for the Medal should be written on one side of the paper only, with marginal space on the left hand side thereof, and limited to, say, about 32 pages of the "Queensland Geographical Journal," Royal 8vo. Instead of the writer's name each paper must be identified by a motto. A sealed envelope with such motto written outside, and the writer's name and address inside, should accompany each paper.

The successful papers will be printed and published in the Journal of the Society, fifty reprint copies of each being supplied to the author, free.

All communications, with illustrations for which the Medal may be awarded, must be written in the English language, and will become the property of the Society absolutely.

Papers may be illustrated by such maps, diagrams and pictures as are considered by the authors thereof to be necessary and useful.

Additional subjects for future papers will be announced from time to time.

All communications should be addressed to the Hon. Secretary of the Society, Brisbane

J. P. Thomson, *Hon. Secretary.*

QUEENSLAND GEOGRAPHICAL JOURNAL

(*NEW SERIES*).

Including the Proceedings of the Royal Geographical Society of Australasia, Queensland.

22nd SESSION,

1906-1907.

J. P. THOMSON, LL.D., Hon.F.R.S.G.S., Etc., Etc., *Honorary Editor.*

The Authors of Papers are alone responsible for the opinions expressed therein.

VOL. XXII.

PUBLISHED AT BRISBANE BY THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

NOTE.—All communications should be addressed to the Hon. Secretary, at the Rooms of the Society, Public Library Building, William Street, Brisbane.

THE

Royal Geographical Society of Australasia,

QUEENSLAND.

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His Excellency The Right Hon. LORD CHELMSFORD, K.C.M.G.

Vice-President:
Hon. Sir ARTHUR MORGAN, Kt., M L.C.

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CONCERNING OCEAN DEPTHS.*

By CAPTAIN WILLIAM EATON.

During that long and dreary period known as the Middle Ages there was little or none of Geographical knowledge. This ignorance of the physical world had existed since ever the world was. No barbaric wave of Huns, or Vandals, had swept over any former knowledge. Great empires had risen, culminated, and decayed; poets, philosophers, historians, and mathematicians had lived, and left their impress on all time, but what was known of the earth was curiously little. For thousands of years those countries bordering on the Mediterranean, formed all or nearly all the extent of the geographical knowledge. It is interesting to note, that one short century was sufficient to dispel the mists and vapours of this long night of ignorance, and lay the foundation of our science of geography. It has been well said by Hallam, that the discovery of the mariner's compass has influenced the fortunes of mankind more than all the deductions of philosophy. Before this event the world appeared to be in its second childhood or the senility of old age. But then it renewed its strength and became strong and vigorous with a new manhood. New worlds came into existence, science kept pace with discovery, the long pent up intellect of ages burst its bonds, and the Ptolemaic geography, with its accompanying Aristotelian philosophy, disappeared. But although the world since then has yielded up its secrets bit by bit, still up to the nineteenth century period our knowledge of the ocean was extremely vague. During the earlier Middle Ages, the ocean was invested with a great mystery, and regarded with an equally great dread. It was supposed to be an immense rim of water surrounding the solid earth, and all beyond was Tartarean darkness, and unutterable terror. The sea was spoken of with awe and wonder. An

* Read before The Royal Geographical Society of Australasia, Queensland December 17th, 1906.

Arabian writer of that period who is quoted by Washington Irving, says :—" The ocean encircles the ultimate bounds of the inhabited earth, and all beyond is unknown. There is no mariner who dares enter into the deep waters through fear of its great obscurity, its profound depths, its frequent tempests, and its mighty fishes." Horace, the genial Roman poet, also writes :—

" What form of death could him affright,
Who unconcerned with steadfast sight,
Could view the surges mounting steep,
And monsters rolling in the deep,
Could thro' the ranks of ruin go
With storms above and rocks below."

Until the last half century very little was known of the ocean either physical or biological. Poets had sung of and philosophers moralized on its various moods ; but our knowledge to-day of the planet Mars might safely rival what was then known of the depths of the sea. It was looked on as a troublesome and often stormy highway of commerce, or from whence a supply of fish could be obtained for the use of man. It has often been the battle field of nations. The fate of empires has not seldom been decided on the sea. When the seaman is approaching land, it may be that owing to fog or rain or other causes, he may be doubtful of his position. He therefore takes the depth of the sea wherever he may be placed. This is called taking soundings. By doing this he avoids disaster. This is one of the simplest forms or methods of navigation, and is also one of the oldest. The Romans, although masters of the known world and excelling in many of the arts and civilizing influences of life, were very poor sailors. It was in a Roman galley of the first century that we first hear specially of sounding. During that ever memorable voyage which St. Paul made from Cæsarea to Rome,* an easterly gale was encountered, which was so severe that the ship was run before it. The captain having lost his reckoning (a not uncommon occurrence even with modern captains) and fearing that land was dangerously near, did precisely what the shipmaster in like circumstances does to-day ; that is, he sounded, and found he was shoaling his water very fast. Columbus was a firm believer in the geography of his age, which placed a very narrow Atlantic Ocean between Western Europe and Eastern Asia ; consequently, when thirteen days out on his first voyage to America he attempted to find bottom with a 200 fathom line. Possibly about the same place the Challenger expedition 381 years afterwards found a depth of over two miles. Magellan also on his great voyage across the Pacific Ocean endeavoured to

* Acts of the Apostles, Chap. xxvii., Verse 28.

sound its depths with a line of same length, quite unaware of the fact that throughout the areas of the great ocean the depths were from 3 to 5 miles. About two centuries later, ocean sounding engaged the attention of a few scientific minds and assumed a more important character than merely to locate the position of a belated vessel. A few isolated and not very accurate attempts were made, not only to ascertain the extent but the nature of the sea depths. Even of the fauna inhabiting the shallow waters bordering on well known coasts very little was known unless what may have been found among the debris of a beach after a storm, or of the flora unless what was seen waving in stormy grandeur amid the stormy surges at low tide. The French geographer, Philip Buache, who first introduced isobathic or equal temperature curves in a map published in 1737, was the first to give serious attention to the study of the conditions of the ocean. He considered that the depths of the ocean were prolongations of the condition existing on the neighbouring sea coasts, which is probably true as regards the sea bottom in the immediate vicinity of land. About the same time Count Marsigli, an Italian, interested himself in many of the problems of what was then known as the deep sea. He collected information from the fishermen on his coasts and tested the temperature at the various depths then available. In 1749 Captain Ellis, when off the N.W. coast of Africa, sounded in 890 fathoms, and found the same temperature as at the surface. Experiments were also made on the salinity of sea water by our distinguished chemist, Robert Boyle. Cavendish about the same time invented the self-registering thermometer, an instrument very necessary to the investigation of great depths. In 1820 Sir John Ross, when about two miles off the coast of Baffin's Bay, made some remarkable soundings, one of 1,000 fathoms, of which more shall be said afterwards in this paper. During Sir James Ross's expedition to the Antarctic with the "Erebus" and "Terror," the temperature of the water was observed at a depth of 2,000 fathoms. Since then there has been quite an international rivalry in deep sea exploration. Every European government, as also the United States, have taken part in the quest. Almost every sea and ocean has been explored. About the time of the "Erebus" and "Terror" Antarctic expedition the United States sent out Wilkes on a similar voyage of exploration, and the surveying ship "Beacon" with Professor Forbes made extensive dredgings in the Ægean Sea. About 45 years ago the Austrian frigate "Novara," with a scientific staff, navigated the world. In 1868-9 the surveying ships "Lightning" and "Porcupine" made valuable dredgings and soundings in the North Atlantic, under Wyville Thomson, Carpenter, and Jeffreys. In 1876

H.M.S. Challenger returned from a 3½ years deep sea exploring expedition, during which time she had traversed 70,000 miles over the waters of the globe. This was the most completely equipped expedition of its kind, and largely increased our knowledge of the sea and its conditions. The first systematic attempt at sounding over a large area of ocean was in 1856, when the bed of the North Atlantic between Great Britain and Newfoundland was surveyed for the proposed Atlantic cable. Since then cable laying has been productive of a large amount of knowledge concerning the sea and its depths, and has also been the means of perfecting the mechanism of deep sea sounding apparatus. The earlier expeditions were considerably handicapped by the defective means then in use. The ordinary method of sounding in moderate depths was by using a block of lead about 30 inches long, slightly tapered towards the upper end, and from 30 to 100 lbs. in weight according to expected depths. The lower end of the lead, where it must first strike the bottom was hollowed and filled with soft tallow. It was sunk into the sea by a hempen line about 3/8 of an inch in diameter, which was marked by various coloured worsteds or slips of bunting in fathoms, tens of fathoms, and hundreds of fathoms. When the lead reached the bottom, the impact was noted, and the depth ascertained by the coloured marks on the line. On recovering the lead, a sample of the kind of bottom, such as sand, mud, shells, gravel, or whatever else, was found sticking to the tallow on the end of the lead. This method, like many other time honoured customs is hallowed by old associations, but is now becoming obsolete. It had been used by all navigators before and after Columbus. We may even imagine without undue mental violence that the Phœnicians in like manner sounded the foggy coasts of ancient Britain or the barbarous Baltic. It is still used in coastal traffic for navigational purposes, and is effective enough up to a hundred fathoms. But the depth of old ocean far exceeds this modest amount. To reach great depths, it was necessary to use great weights. The weights used were so heavy, and the labour and time involved in bringing them from the bottom were so great, that the mechanism is now so arranged that on touching bottom they are detached, and left on the ocean floor. The sounding tube to which they were fastened is automatically filled with specimen mud, and brought up without difficulty. In place of the hempen line, a fine steel wire is sometimes used. It may be interesting to mention that as the sounding weight is sinking to the bottom, the time interval between each mark on the line lengthens, owing to the increasing density or resistance of the water. Sir Wyville Thomson tells us that he sounded in the Bay of Biscay in 2,435 fathoms, or roughly 2½ miles, with a weight of 3 cwt.

The first hundred fathoms ran out in 45 seconds, but the twenty-fourth hundred took 112 seconds. The whole time for the 2435 fathoms being 33 min. 35 sec. It is noteworthy that the many inventions and improvements connected with deep sea sounding have been effected by navigators and scientific men while engaged in their work of exploration, and such inventions and improvements have been the means of a more intimate acquaintance with the great submarine world, its temperatures, its currents, and wonderful wealth of animal life. The inability of the earlier expeditions to secure trustworthy soundings, led to great exaggerations. Thus a reported depth of 8,000 fathoms (about 9 miles) in South Atlantic was subsequently corrected by the Challenger to 2,400 fathoms. It has been found that the deepest parts of the sea are generally in the vicinity of volcanic islands. Certain very deep pockets or gullies far in excess of ordinary ocean depths have thus been discovered. In 1874 the American surveying vessel "Tuscarora" found a depth of 4,612 fathoms just east of Japan. The Challenger discovered an almost similar depth 1,400 miles south by east from Japan. But the greatest depth yet found was by the German exploring vessel "Valdivia," just north of the Carolines, where a depth of 5,269 fathoms was discovered; just six miles! It is almost as difficult for the mind to realise a depth of six miles of water as it is to grasp the idea of stellar distances. When we consider the lofty mountains on every continent and the immense hollows at the bottom of the sea, we would naturally imagine that this globe of ours, whirling for ever through space, must have a very uneven and jagged spherical contour. But we are told that all the various protuberances and mountain ranges on the land, together with the immense chasms in the ocean depths, bear no more proportion to our planet than does its rough skin to an ordinary orange. These abysmal depths are however uncommon and as rare as are our great mountain ranges. When a science is in its infancy, facts and data are few and simple. But as these accumulate the science becomes complex, and classification is necessary to secure symmetry to the edifice. Several zoologists and geographers, notably Professor Forbes, have attempted to divide the ocean depths into vertical sections, or zones. The earth's surface owing to climatic conditions is so divided. But this arrangement has not been found satisfactory for the ocean, owing to the very vague and uncertain conditions on which it rests. The study of sea depths has to be pursued under exceptional circumstances. Oceanography has small chance of ever being what is termed an exact science. Until some invention, optical or otherwise, and as serviceable to ocean depths as the telescope is to depths of space, has given us the power to survey where now we can

only probe with the sounding machine, we must be dependent for our knowledge on occasional and costly expeditions. This is quite different to the other sciences, which can be studied by their individual votaries without any special physical obstacle. From every " scarped cliff and quarried stone," the geologist can read the history of our earth from its nebulous condition to its present apparent completeness. But it is very different with deep sea research. The results of the sounding line, the dredge, and the thermometer of the surveying vessel, have opened up to us a marvellous submarine world, but they are such as to render the classing of the ocean into vertical zones contradictory and uncertain. The ocean, however, may be safely divided into two strata or zones. As light and darkness are the two great distinctions in our aerial world, for the sake of simplicity and to avoid confusion the same two conditions may characterize the ocean world. Sunlight permeates the upper regions or surface waters to a depth of from 200 to 300 fathoms according to the purity of the water, and the abundance of minute animal life which it may contain. Below all is impenetrable gloom. There is no sharply defined limit between the upper sun-illumined zone and the lower darkness. The two conditions merge into each other, as in our own world, the brilliancy of the day-light, is gradually eclipsed by the darkness of night. Ideas, which we would now term absurd were not very long ago prevalent regarding the great depths. That far down those cavernous depths, the gravity of water was such that no object, even of weight, could ever reach bottom ; that the countless wrecks and sunken war fleets and treasure laden galleons, with all the accumulated wrack of ages, remained for ever suspended in intermediate depths, like the fabled coffin of Mahomet between earth and sky. On the shores of continents are sea margins, extending outwards from the land to a hundred miles, and in some instances to several hundreds, and increasing gradually to a depth of a hundred or more fathoms. When we get beyond this shallow margin the bottom sinks rapidly until the true ocean bed is reached, at an average depth of about 2,000 fathoms. Not taking into account the oceanic islands, or the exceptional depressions and abysses, it is found that the ocean beds are uniformly flat. Dr. Carpenter says " That the form of the depressed areas which lodge the waters of the deep ocean is to be likened to that of a flat waiter or tea tray surrounded by an elevated and steeply sloping rim, than to that of the basin with which it is commonly compared." The configuration of the bottom of the North Atlantic is such that when surveyed for the telegraph cable it was remarked that an observer standing on any spot of it would find himself surround-

ed by a plain, only comparable to that of the North American prairies, or South American pampas—interminable flats of grey white mud, with here and there an Arctic boulder dropped—it may be from some stray passing iceberg. This mud is formed from the debris of the Globigerina shells, which having passed their lives in the surface waters of sunlight descend at death to the regions of darkness below. On their slow downward journey their calcareous coverings are disintegrated by the action of the carbonic acid in the lower depths and form the deposits known as Globigerina ooze. This ooze or mud is abundant and found in all depths between 250 and 2,900 fathoms, and from fairly high northern latitudes down to 50 deg. south. Until exploded by the results of the Challenger expedition, it was the belief of many eminent scientific men that those depths contained the Primordial slime, out of which all living things were supposed to have been developed. It may be interesting to note that Globigerina shells are so small that thousands scarcely weigh a grain, and to examine them closely a microscope is necessary. But Nature is impartial and bestows as much care on the structure and beauty of the infinitely little as on creations huge and gigantic. It has been said that the force which moulds a tear rounds a planet. To make amends for their size they have ever been in numbers so incalculable throughout great geological periods as to form chalk cliffs and limestone formations from their remains. But in the greater depressions of the ocean bed is found another and far more abundant and interesting deposit, viz., the red clay. It is of volcanic origin and is found largely in the neighbourhood of volcanic areas. In this red clay region are also found dust and ashes and pumice, which have in the first place been carried to sea by winds blowing over volcanic areas. Mingled with these red clays the Challenger expedition found coral encrusted with a coating of manganese. In one instance their trawl brought up 600 sharks' teeth, 100 ear bones of whales, and 50 fragments of other bones ; some of these were embedded in manganese an inch thick. Many of the sharks' teeth were very large, one being four inches across the base. They were fossil teeth. No shark of our day, big and ferocious as he is, has such formidable grinders. Some enormous devastating creature of a bygone age, to which our present day shark is but a pigmy, had once owned them. Such teeth are found in many of the Tertiary formations. Lord George Campbell, in his "Log letters," explains the origin of manganese in these red clay deposits :—Wherever we have pumice containing much magnetite or hornblende, and these apparently undergoing decomposition, or where we have showers of volcanic ash, there also is manganese in the greatest abundance. Manganese is as frequent as iron in lavas.

It is therefore probable that the manganese as we find it is one of the secondary products arising from the decomposition of volcanic minerals, that decomposition being caused by the carbonic acid and oxygen of ocean waters. Another mud deposit or ooze termed Radiolarian is found in the deepest parts of the western and middle Pacific Ocean. . It is formed from organisms with partly insoluble siliceous shells or skeletons in contradistinction to the calcareous shells of the globigerina. Diatomaceous ooze is principally found at the bottom of the southern seas. The diatom is a very minute organism and is in such numbers that they often form bands of green on the surface. Such may often be seen on a calm day at sea off our Australian coast. In the Antarctic the principal source of food for whales, seals, birds, fishes, and other animals is found in the vast meadows of diatoms. The diatom also forms a siliceous skeleton. Strewn over the various deposits constituting the ocean floor are minute granules of native iron supposed to be of meteoric origin. Meteors as we know are ceaselessly raining on our earth from far off planetary skies. On coming into collision with our atmosphere they are burst into fragments and scorched into dust. This dust falls on land and sea alike. On land it is inappreciable, but the trawl and dredge bring from the depths of the sea this visitor from other worlds. Geologists of a former day, notably Sir Charles Lyell, upheld the doctrine of successive alterations of land and sea. Which meant that during the geological ages our present continents were at vast recurring periods engulphed, and the present ocean depths received THEIR innings by being in turn elevated into continents. That a regular upheaval or depression of the one or the other was continually going on. Tennyson illustrates this when he tells us—

" There rolls the deep where grew the tree.
Oh ! earth what changes hast thou seen ;
There where the long street roars hath been
The silence of the central sea."

When poets turn scientists their poetry may be good, but their science is often faulty, and in this verse we have a Falstaffian ha'porth of science to an intolerable quantity of poetry. Apart from the concurrent testimony of Prof. Dana, Dr. Carpenter, A. R. Wallace, and others against the alternate rise and fall of the great continents and immense ocean basins, the ocean deposits bear testimony against it. These have no connection with or resemblance to those of the marginal seas bordering on the continents—the debris of rocks, of siliceous sands, of the outpouring of great rivers, and the remains of animals and plants. We have no data as to the thickness of the ocean deposits or their rate of deposition. We cannot arrive at a definite idea as to

the age of these oceanic basins by the same inductive reasoning as that by which the erosion caused by Niagara Falls enables us to speculate as to the age of the earth's crust, or by the Nile mud, its rate of augmentation, its present thickness and the remains of human handiwork found therein. But the fossil remains found on the ocean floor and the occurrence of meteoric dust in these depths all point to an extraordinarily slow rate of deposition (throughout immense periods of time, and to an absence of all evidence whatever of a submerged continent. The contour of the coast lines and the areas of land and water on the marginal shallow seas have changed from time to time, but our existing continents and great ocean basins, in their general features and configuration, have their origin in the remotest geological ages. The poet has, as usual, stepped in where science fears to tread by telling us that—

"Full many a gem of purest ray serene
The dark unfathomed caves of ocean bear."

But if we would realize the conditions of the deep sea we must discard all such poetic creations. There is little or nothing in the ocean world akin to things sublunar. As has been said sunlight penetrates the surface waters to a very limited distance. Below this remains an average depth of $2\frac{1}{2}$ miles, where reigns eternal darkness, where night and day are words of no meaning, where there is no sound, not even faint echoes from the world above, where the rolling year brings no alternate seasons, where the furious cyclone with its devastating seas produces no sympathetic ripple, where there is no polar region or torrid zone, and where all is cold, dark, and to our ideas, dismal. But if this ocean world is devoid of what we term beauty, it can at least claim a certain amount of sublimity. This feeling is not lessened when we become acquainted with the population of the great deep. A knowledge of such animal life was not the least important result of the many exploring expeditions. That marine oceanic life was limited to a depth of about a third of a mile owing to enormous pressure, was a doctrine quite prevalent two generations ago.

This belief has been relegated to the limbo of dead facts and exploded theories. A pressure of three tons to the square inch at a depth of three miles, a total absence of sunlight, and a temperature at the freezing point, might well warrant objections to life under such conditions. Specimens have been brought up alive from depths exceeding four miles, proving that the class termed invertebrate, or soft, boneless bodied, can live without discomfort irrespective of depth, absence of sunlight, or extreme temperature. Their construction is so adapted to those conditions that they seldom survive the change of environment by being brought to the surface and the pressure

suddenly removed. We who live at the bottom of an ocean of air have each to bear a pressure of about 13 tons, but we feel no inconvenience. When the mercury in the barometer rises a few tenths, a considerable amount of additional weight is piled upon each of us; but we feel no additional discomfort. Generally speaking we are livelier and more exhilarated. Our environment is so exact in every constituent that were we to be transported say to the summit of Mount Everest we would be in a similar plight to the deep sea fish brought to the surface. Nearly one hundred years ago Sir John Ross commanded an expedition to the Arctic, a region associated with many heroic and often tragic enterprises. He was in pursuit of that ignis-fatuus, which for three centuries was the goal to which all the efforts of the great navigators were directed, viz., the North-west passage. But Sir John was not only a great seaman, but a scientific man (a very rare combination in his day), and consequently sounded in Baffin's Bay in a depth of about a mile. A number of animals, such as worms, corallines, and crustacea were brought up sticking to his sounding lead and entangled in the line, thus demonstrating the existence of animal life at that depth. In 1860 the telegraph cable between Italy and the French coast of Africa broke. A fragment of it was picked up from a depth of 1200 fathoms and found to be encrusted with sponges, corals, polyzoa, molluscs, and worms. Several of the animals thus brought to the surface were identical or supposed to be with forms hitherto regarded as fossils. The sounding machine alone can give only partial results to scientific enquiry. Consequently with systematic exploration the dredge, the trawl, and the thermometer came into use. The dredge has done for the bottom of the sea what the telescope has done for space—brought to view the far off and the unseen. It is sunk by a sufficient weight and after dragging over the sea bottom by the slow onward movement of the vessel, it is raised to the surface, bringing with it samples of mud or specimens of animal life or it may be fragments of fossil remains or possibly some stray fish captured in intermediate depths. The trawl is a similar machine with modification. The thermometer is a most important instrument in discovering what the poet Longfellow calls "the secret of the sea." It gives us serial vertical temperatures, whereby we arrive at a correct knowledge, not only of the depth and extent of the surface currents, as the Equatorial current and Gulf Stream, but also of the nature and direction of those great under currents which flow unseen and unfelt over the ocean bed from polar to equatorial latitudes, and exercise a world wide influence on the laws and economy of nature. In speaking of thermometers it is interesting to note that Sir Wyville Thomson tells us how even the

protected thermometers of the "Challenger" were not infrequently crushed by the great pressure at 2000 fathoms, the glass being reduced to a fine white powder almost like snow, while the copper protecting case was bulged out of shape. The result of the various expeditions has shown that not only the surface layer, but all the intermediate zones teem with life, and that the ocean world is as wonderful and as varied as is the world which man inhabits. Our knowledge has been laboriously gained and as yet is far from complete. But we know that there is no depth at which animals are not found. Prior to the Challenger expedition, our knowledge of deep sea fishes was very limited. "It was owing to the evidence afforded by the anatomical structure of a few peculiar fishes, obtained in the North Atlantic, that it was surmised that these fishes inhabited great depths of the ocean, and that their organisation was specially adapted for living under the physical abysmal conditions."* The osseous condition or structure of such fishes is remarkable in its adaptation to great pressure, but the most striking feature is in the organs of vision, which illustrate Nature's law of rendering torpid and useless any organ of the body no longer used. As a very narrow strait or sea may divide two totally different types of animals, so sunlight is the impassable barrier between the surface fauna, and the intermediate and abysmal forms of life. The fishes which roam throughout these depths present no new type, but are only modifications of pelagic life. To be able to find their way through the murky darkness, their eyes undergo curious modifications. Unlike man, who calls in optical aid, they quietly make the best of their unlucky environment. Even at not too vast depths their eyes are largely out of all proportion to their other organs in size. Among the deep sea cod, for instance, are those which visit the waters down to 1,000 fathoms. These make the most of what glimmering twilight there may be by having eyes unusually large. There are others that discard their eyes altogether as encumbrances, and trust to find their way about by using long tentacles or feelers, much in the same manner as a blind man feels his way through the streets, by his stick. There are also fish which carry their own lanterns in the shape of phosphorescent light. Sometimes this phosphorescent organ is placed on the tip of a tentacle or feeler, and doubtless lures many a simple inquisitive fish to ruin, just as not so long ago unprincipled Cornish wreckers with false lights are said to have decoyed storm tossed vessels to destruction. Great numbers of deep sea fish having their habitat in the upper layers or zones, display phosphorescence, and many of those visit the surface at night. The writer has often witnessed in the

*"Study of Fishes," by Günther.

star-lit darkness of a tropical sea, shoals of phosphorescent fishes, swimming in company and keeping pace with the vessel and illuminating the water with meteoric flashes, or in apparent playfulness darting across and across the bow leaving great trails of gleaming phosphorescence behind. When Nature fails to supply them with phosphorescent lamps she benevolently provides them with spectacles. In the account of the voyage of the German ship "Valdivia," latest of the world's deep sea explorers, we read of a series of fishes whose eyes stand out from their head like a pair of binoculars, and similar telescope eyes occur in many eight armed cuttle fish. Our land animals are restricted by climatic conditions to a special habitat. Their existence is a question of latitude. Between the poles and torrid zones is a great gulf fixed which they can never bridge. Even man can only change his environment by exercising faculties denied to the lower creation. But there is no such limit to the inhabitant of the deep. At depths below 1000 fathoms the conditions of the sea are practically the same horizontally from pole to pole. Therefore there is no physical impediment to prevent a deep sea fish, desirous of bettering its condition, leaving the North Atlantic, cross the Equatorial abyss, and establish itself as any colonist might do in the Southern Hemisphere. Those fishes although sunless and sightless, and doubtless labouring under other personal inconveniences, are by no means academic or platonic in their nature, nor are they without those homely instincts which make the whole world kin; for their structure gives evidence of a most tigerish voracity. "Some of them have a stomach so distensible and capacious, that it can receive a fish twice or thrice its own size. Deglutition is performed in them by the independent and alternate action of the jaw, as in snakes. They cannot be said to swallow the food, but rather draw themselves over the victim."* A genus called MEGALOPHARYX, meaning MIGHTY GULLET, has been established as a deep sea eel, one which but for its long wisp of a tail might be described as all mouth.‡ The great ocean world has its inconveniences from a naturalist's point of view, owing to its great depth and world wide area. There is also sometimes an uncertainty as to the exact depth in which the captured fishes have been found, thus making it difficult to confer on the deep sea fishes or swimmers a local habitation. The term swimmer is used in contradistinction to that other section of deep sea fauna, which live and move and have their being on the ocean floor, can neither swim nor float, but are either fixed or creeping about. Hackel employs the term BENTHOS to denote this class of animals, probably from Benthal, a

*"Study of Fishes," by Günther.

‡Voyage of "Valdivia."

Greek word signifying the depth of the sea. If in this age of wonders man should ever be able to visit or view the sea floor, instead of scratching over it with a very uncertain and unsatisfactory dredge, he would behold a sight to which he could find no parallel in his experience. Monotonous the ocean bed would appear, but teeming with life, abundant and varied. But even the dredge reveals a surprising variety and wealth of form. At one haul in the Southern Ocean the Challenger dredge brought up from a depth of 1375 fathoms 200 specimens. Members of nearly every class of the animal kingdom inhabiting the surface waters are to be found in the depths, but showing in their modified structure the peculiar condition under which they now live. Protozoa, sponges, round worms, annelids, crustacea, polyzoa, brachiopods, molluscs, echinodorms, and ascidians. In all scientific works there are necessarily scientific terms, which trip up the general reader and vex his soul, and some explanation of these seemingly hard words may be necessary, to those whose studies do not lie in the direction of Natural History. The lowest class of animals in the sea and also the smallest is designated Protozoa. This title comprises what is known in natural history as a sub-kingdom, and although the general structure of animals composing it is only a globular speck of jelly-like substance in a single cell, Nature is so lavish in her workmanship that even this is divided and sub-divided in classes, orders, and species. If shelly sea sand be looked over with a lens there will be seen tiny shells no bigger than the grains of sand amongst which they lie. Each of these shells had once contained a living animal. This is the Foraminifera, an order belonging to the Protozoa. There are other orders belonging to the Protozoa, but this one presents us with an object no less wonderful than instructive. Even the Foraminifera is divided into species. The shells of one species in size from a grain of sand to one-twentieth of an inch compose the limestone of the Paris Basin, and a considerable part of Paris is built of the same stone, in which the tiny shells can be distinctly seen with a lens. This species of Foraminifera is of world wide distribution, from the shallow shore to 3,000 fathoms. Another inhabitant of the deep seas is the sponge. We are all familiar with the sponge. I will not inflict on you the scientific name of the sub-kingdom to which it belongs. It is not only a household article, but as a word it has crept into the language, enriching it with a new verb, and several new conceptions. It is irrelevant certainly, but interesting to notice that to sponge is to lave, to wash, to wipe. The dictionary also tells us in its didactic manner that to sponge is for us to gain a mean advantage by hanging on, a conception in some remote manner connected with a sponge in the sea hanging on tenaciously, as is their wont to a rock or where-

ever else fixed. The word is also honoured by the prize ring fraternity to express defeat by throwing up the sponge. To still further illustrate the vagaries of our language, it is a word which our bakers would find it very difficult to do without. But philology is not our theme. Natural history tells us that there are about 2,000 species of sponges scattered throughout the waters of the world—in fresh water rivers, in shallow seas, and in solitary ocean depths. We are all familiar with the sponge, which is used for toilet purposes. But this is only the dwelling in which the sponge once lived. The sponge at the bottom of the sea is a living organism a little higher in the social scale than the Protozoa of which we have just been speaking, in the fact that it is lodged in a more elaborate manner, just as our neighbour may claim a higher social standing by being able to live in a grander mansion. The sponge organisms when in life herd together in monastic communistic clusters and form around them and through their midst, a horny fibrous framework. In this they live only to themselves, doubtless enjoying all things common in a truly socialistic manner. The sponge framework is perforated by a system of canals or intricate network, which admits and emits a continual flow of water, and also minute living organisms, which are not emitted, but retained as food for the inhabitants within. The sponge is further strengthened by siliceous spicules, resembling needles of glass protruding from the framework. It is these spicules which have created so widespread an interest in the sponge. They are in forms of great variety and elegance and often make magnificent structures resembling spun glass. There are so many varieties of spicular arrangement that a very elaborate vocabulary of over 50 Latin designations is thought necessary for their classification. In the shallow seas where the sponge is subject to the strain and stress of tidal action they are of every variety of shape, but those of great depths attached to a stone or rock, or rooted by a stalk into the mud, and where there is no disturbing element, have a symmetry as perfect as a lily. To the multitude the coral is even more familiar than the sponge. Since Darwin's time a scientific controversy has raged concerning it, and a great deal of capital poetry embodying much untrustworthy science has been let loose on a credulous world relating to it. But the deep sea coral is not exactly the same as the reef building kind, only a sort of poor relation ; not very numerous at great depths and having no special mission, quite unlike their cousins at the surface, who have raised and are raising monuments compared with which man's greatest achievements are as nothing. Deep sea corals find it difficult to manufacture lime as the reef building corals do in the waters above. Their labour takes the form of a branch like structure. Owing to this inability to form a

skeleton of calcareous matter it is of a soft and yielding character. "The secretion takes the form of minute calcareous particles of definite shape scattered about between the outer skins and the lining of the body-cavity. These spicules never fuse together to form solid continuous masses, but may nevertheless be present in sufficient quantities to give the lower part of the body a certain degree of rigidity." * This species is rare at great depths, but specimens were obtained by the Challenger expedition in the Indian Ocean at 2,500 fathoms below the surface. They too are mostly self luminous, displaying phosphorescence. The movements of deep sea animals of the lower order are apparently so automatic, that their position seems to lie in some undefined region between the animal and vegetable kingdom. But the coral reproduces itself by eggs, and Professor Dana asserts that it is as much an animal as a dog or cat. The deep sea animals I have mentioned, the foraminifera (Protozoa), the sponge (Porifera), and the coral (Coclenterata), are individuals belonging to the lowest group of the animal kingdom. After these we ascend higher, and the structure or organisation becomes more complex. A neighbouring group, evolving many characteristics not found in the preceding is the Molluscs. In this group is comprised jellyfishes, squids, the highly organised cuttle fish, often carrying their own lamps, and shell fish of all kinds, and at all depths, from the huge clam (Tridacna) to the humble periwinkle, known as Littorinidae. Many of these of course occur in shallow rocky plateaus, but the deep sea is plentifully populated by their representatives. The starfishes, the sea urchins, and the sea cucumbers, which we see lying inert on the sea beach at low tide, crowd the deep sea floor. The homely and expressive name of sea cucumber has its scientific equivalent in *Holothinian*. The sea-cucumbers of coastal waters are interesting as furnishing a food known as trepang, which ranks with edible birds' nests among the delicacies of a Chinese table. The fishing for trepang or beche-de-mer is very common along our Barrier reefs. The ocean bed is also thickly populated with what is known as jointed animals or Crustacea, such as shrimps, crabs, crayfish, prawns, &c. In these animals there is a distinct advance in the social order. Most of them are possessed of a heart which performs similar duties to those of our own, viz., pumping the blood into the body after being aerated through the lungs, only in this case it is through the gills. They are superior to us in having not two legs, but several, long stalky stilts very serviceable in getting over the muddy ocean bed. Originally there were fitted out with eyes, but in their dark abode such were of little or no use, and Nature

* Royal Natural History, Vol. VI.]

ever beneficent has furnished them instead with exceedingly long antennæ, very convenient weapons not only for finding their way about, but for seizing any passing object that may serve for prey. As Nature kindly compensates those of ourselves who are blind by conferring extra acuteness on the other senses, so the sightless prawns appear to possess the power of securing their prey by the sense of smell. Everything pertaining to life is on a profuse scale in the ocean depths. The "Valdivia" expedition dredged a species of prawn having antennæ nearly five feet long, strangely projecting from a body less than twelve inches. Others are spoken of with feelers ten to twenty times as long as the body. Mr. J. Stanley Gardiner, lecturer on Zoology, Cambridge, and leader of the Sladen's Trust expedition for exploration in the Indian Ocean last year, tells us that from a depth of 1200 fathoms enormous squid were fished up as well as jelly-fish and gigantic prawns. Some of them were blind, while others had huge eyes, and nearly all of them had phosphorescent organs due to the fact that they lived in total darkness. The blind varieties had enormous feelers extending several times the length of their body. The colours of deep sea fishes are extremely simple, being either black or silvery. Many have a skin so white and transparent that the blood inside can be seen and its course traced even in its finer threads. Although unlike the land fauna, there is no particular colouring among the inhabitants of the deep sea, the luminous organs which so many of them possess may also act in the offensive or defensive as required. There is a great deficiency in lime in bones of the abysmal fishes, being very gristly and stringy in their composition and their scales also being thin and silky. The shells of deep sea molluscs are transparent as tissue paper, and that which in surface waters is armour to the crustacea is but a roughened covering having no lime in its composition. All these various conditions are merely adaptations to environment, just as much as is the structure of a bird's wing or the climatic fur of the polar bear. The law of adaptation governs the animal creation, and this adaptability is the more remarkable and interesting when we consider the various changes and vicissitudes which marine life has undergone, since its first appearance on earth. Man's place on earth is but of yesterday, in the immensities of time he is but a new comer. It is impossible to find figures to convey intelligently to our minds the number of miles which lie between us and the *Pleiades*, and it is equally impossible to measure by years the time which has elapsed since the zoophytes first commenced rearing the coral formations. The primeval ocean was rich with life before even the frondiferous ferns which now constitute our coal supply existed. The vast geological ages cannot be measured by any arithmetical formula,

and we only know that such life existed, for the history thereof is written in the limestone formations, the coral reefs, and the chalk beds of the world. Deep sea animals are by the very nature of their surroundings carnivorous. They must suffer under a continual hunger. The structure of the fishes plainly shows this. Many of them have enormous jaws taking up in length one-third of the body, with great recurving teeth, so that the victim having once entered may, like the inmates of Dante's hell, abandon all hope of ever getting out. Their lives are passed in eating others, and being themselves eaten. We ourselves go through the same process, although it may be in a modified manner. It is not long since—

"The good old way, the simple plan,
That they should take who have the power,
And they should keep who can."

was very much in vogue. Also *land shark* is a very common colloquialism, descriptive of those who by fraud and falsehood obtain some advantage not honestly due. And an Edinburgh reviewer told us the other day, that in the intellectual world the highest education consists in teaching us to feed upon the thoughts of others, that we may supply thoughts for others to feed on. This however by the way. But cannibalism cannot support forever the inhabitants of the deep sea. There must be a limit or complete depopulation would be the result. The deep sea is perfect Sahara of infertility, consequently they have to receive their food from a distance. They have no visible means of support, but the surface waters above form their never-failing storehouse. Sunlight penetrates the waters of the sea to a very small extent, and where there is no sunlight there is no plant life. It is in these regions of light that Algæ and all other marine vegetation live and flourish, and it is by sunlight acting on their green colouring matter or what is termed chlorophyll, that those vegetable organisms can assimilate inorganic matter, and recombine these elements into organic components fit for animals to feed upon. The surface animals have therefore their food at hand, while their deep sea brethren, not so fortunate, receive theirs in importations from above. The surface layers teem with animal and vegetable matter. It is a very common sight to see patches of calm sea crowded with jelly fish, and on every sea the surface is frequently discoloured with great bands of living matter. The Sargasso Sea is a striking and familiar illustration or example. This celebrated sea is simply a vast meadow of floating life, situated in nearly the centre of the North Atlantic Ocean, and occupying an area it is said of 260,000 square miles. It is so crowded with vegetable and animal organisms that to the eye at a little distance it seems substantial enough to walk on,

and sailing ships in light winds make their way through it with difficulty, as the present writer had the experience on one occasion. Shrimps, crabs, zoophytes, and other lowly organisms of kelp and fucus, swarm among its verdure, and the naturalist of the "Challenger" mentions a species of fish that actually builds its nest and propagates therein. Most of this floating animal matter is of Gulf Stream origin. For the Sargasso Sea is apparently the backwater of the Gulf Stream, and it is so situated between opposing currents and tradewind influence as to neutralise any drift or motion unless caused by the temporary action of the winds. Therefore its latitude and longitude is doubtless the same as when Columbus sailed through it over four centuries ago. Unlike us, who live at the bottom of an ocean of air, the deep sea animals are never troubled with fluctuating conditions of heat and cold, but for ever enjoy a very equable temperature. Heat penetrates the surface waters to a distance of about 550 feet. In 37 deg. south Atlantic, the Challenger sounded in 2,900 fathoms with a surface temperature of 70 deg. From the surface to 400 fathoms the temperature fell rapidly to 40 deg.—at the rate of 7½ deg. to each 100 fathoms. The remaining of 2,500 fathoms the temperature fell only at the rate of ¾ deg, a 100 fathoms. The bottom was absolutely glacial. This glacial condition is with trifling exceptions of temperature the rule throughout ocean depths. The thickness of the glacial stratum is sometimes variable. In this instance it was 1 000 fathoms thick. In polar seas the difference in temperature between surface and bottom is very little. Sometimes it has been noted slightly higher at intermediate depths. In equatorial seas, a surface temperature of 82 deg. is not uncommon, and although the conductivity of salt water is low this heat would in the course of ages descend to the bottom, and the present healthfulness and vitality of the ocean would become corrupt and impaired. But the low temperature of the deep sea is maintained by a steady underflow from the poles to the Equator, which preserves that equilibrium which is ever a predominating feature in the economy of nature. The consideration of deep sea and surface currents opens up a vista equally fascinating and instructive, but which cannot now be touched on. The Gulf Stream with the Equatorial and other oceanic currents—great rivers in the ocean, moving on forever "without haste and without rest," are the great natural agents which preserve the sea in all its beauty and utility. When deep sea exploration commenced, it was expected that in the deepest recesses of the ocean bed forms would be found living, which are known to us as fossils, and that links would be found connecting animals of bygone geological ages with those of the present. But this has not proved to be the case. The deep sea

fauna cannot be regarded as older than the other fauna of the seas. In the deep dark stillness of the ocean the present animals have developed and are slowly undergoing fresh modifications.

Authorities : " Log Letters of Challenger," by Lord Geo. Campbell ; " Nature and Man," by Dr. Carpenter ; " Depths of the Sea," by Sir Wyville Thomson ; " Study of Fishes," by Günther ; " Royal Natural History," Vol. VI.; " Realm of Nature," H. R. Mill ; " Physical Geography," Mrs. Somerville.

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THE MURRUMBIDGEE WATER CONSERVATION AND IRRIGATION SCHEMES.*

By J. P. THOMSON, LL.D., Hon. F.R.S.G.S., Etc.

INTRODUCTORY.

In dealing with the vitally important matter of water conservation and irrigation it is necessary to consider the subject from the geographical as well as from the purely professional standpoint. And it should be fully understood and generally recognised that the one phase of the subject is even of greater importance than the other in its scientific and economic aspects, since the success of any scheme for the control of a large body of water, its distribution and utilisation for industrial purposes, will largely depend on Geographical conditions, their comprehension and careful consideration. To the engineer, the construction of a dam across the bed of a river or the mouth of a deep and narrow valley, the cutting a of water race, the piercing of a hill by a tunnel or the excavation of a reservoir, are merely professional matters, which may or may not serve any utilitarian purpose or be of any permanent value to a country, when merely considered by themselves as monumental structures, apart from their environment. But if in connection with these we take into consideration such local geographical units as are represented by physical structure, geological conditions, vegetation, soils, rainfall, temperature, evaporation, economic aspects, and all other contributory factors to the comprehensive department of Geographical Science, we shall be enabled to reach the utmost limits of utility and crown our industrial labours with that success which otherwise would not be achieved. And it is here the expert services of the modern Scientific Geographer may be most advantageously utilised, for Geography is the mother of many sciences, and its important bearing on the further development of the unlimited resources of this great Australian Commonwealth must be fully recognised if we are to justify our existence as representative Britishers in the great march of Empire and do our duty as the ancestors of a distinctive Austral branch of the dominant British race. In the following remarks it is therefore intended to deal, first of all, with the Geographical side of the subject under treatment, and with the view of presenting the matter in the clearest possible light, it is perhaps more convenient to begin at the beginning of things and we shall then reach a better understanding of the presentation of facts, and be enabled to arrive at more correct and sounder conclusions.

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GEOGRAPHICAL EVOLUTION.

The Geographical history of the Australian Continent is one of the oldest, one of the most diversified and one of the most interesting of all the world's histories. It goes far back, embracing immense periods of evolution and change, from the dawn of Palæozoic times, when land forms like mushrooms appeared above the surface of a vast terrestrial ocean, down to the present. And during all the countless ages that have passed in succession since land masses began to assume some permanent form of existence, there have been occurring such crustal alterations and physical modification as have adapted the habitable globe to the requirement of man. The corresponding changes, too, that have taken place in the surface features, the soils, the vegetation, and the climates of the earth since the advent of animal life are none the less remarkable as revealing to the limited scope of human vision some of the sublimest manifestations of nature, in the evolutionary stages of planetary life. If, for instance, we take as a typical example of such widely distributed changes, the geographical conditions of continental Australia we shall at once see the mutability of all things and fully recognise that in the economy of nature there are no permanently engraved hard and fast lines, and that successive Geological ages are distinguished by some alteration in the configuration of the land mass, the rocks, the physical structure, the fauna and the flora. And it is perhaps convenient to illustrate some of these changes by a mental picture of the dim and distant past, when the eastern and western parts of Australia were represented by some insulated areas surrounded by the waters of a Palæozoic ocean ; when in the succeeding Mesozoic ages these islands were united from north to south, extending to Asia, but divided in the central region by an enormous gulf reaching northerly to New Guinea and Borneo, and by the next Tertiary period, when the continent assumed its present form and the inland waters or Cretaceous sea were limited to a depression near the junction of the Murray and Darling rivers, and the lake regions in South Australia. Here we have an explanation of the origin of our inland rivers and the somewhat remarkable saucer-like structure of the continent, whose central depression is a striking feature. And, here, too, we have the genesis of the great western plains of New South Wales, the Murray river system and the former grand inland streams that once drained the lofty coastal ranges and emptied their waters into the sea at Spencer's Gulf. But these remarkable alterations have not been confined to the topography of the country alone nor to other associated land forms, for we know that contemporary climatic conditions have undergone corresponding changes, and that our present rainfall falls

a long way short of what it was when the luxuriant vegetation of the continent sustained the gigantic faunal types, whose fossil remains have been disinterred from the Post Pliocene drifts of the Darling Downs and Lake Mulligan.

EVOLUTION OF CLIMATE.

And this at once suggests to the mind the important subject of the evolution of climate and the effect of such on the present and future conditions of life, with which man is chiefly concerned. There is abundant available evidence to show that remarkable climatic changes have occurred in the geographical history of the continent within comparatively recent geological times, and we are justified in assuming that such evolutionary changes are still going on and will continue to do so all over the world until animal and vegetable life disappears entirely from the face of the earth. The period of extinction is still remote, but none the less inevitable and will no doubt be preceded by many changes in the faunas and floras of the globe, each succeeding type possessing some distinctive local peculiarity adapted to the environment of life. Even now we are only just recovering from one of those changes in the form of disastrous droughts, which are so inimical to the life of stock and all animals depending for their very existence on vegetation and water. The position is not a happy one to contemplate, for there is no possibility of improvement in the rainfall of the country, as according to the natural and eternal order of things the periods of excessive dryness must become more frequent, more prolonged and more intensified as time goes on, until the adoption of some paliative means will become an absolute necessity for self-preservation. It is not a matter of maximum and minimum solar activity as affecting the climate, nor yet is it a question of cycles, although seasonal changes do sometimes take the form of cyclical periods, coincidental with some celestial phenomena. But no connection has yet been definitely established between the two, nor can any ever be recognised when the whole matter is considered in its true natural and scientific light, taking into account the loss of terrestrial vitality and the eccentricity of the earth's axis as factors that will in some measure contribute to an elucidation and better understanding of the subject.

There is no use in assuming an air of indifference to existing or impending conditions on the principle that "sufficient unto the day is the evil thereof" when, as a matter of fact, the extinction of our pastoral and agricultural industries is already threatened by recurring droughts. The position demands some definite line of effective action and the only remedial measures which suggest themselves at present

are the conservation of water and the utilisation of impounded rainfall for rural industries. And in this connection it must be borne in mind that in the aggregate our rainfall is ample and would meet all requirements were it equally and regularly distributed over the country. But we know that it is not so, and that the evil lies in its uncertain and unequal distribution. Our great aim should therefore be to store as much of the rainfall of wet seasons as will help us to tide over periods of drought. And there is no reason why this should not be done wherever facilities exist for the conservation of water.

In many parts of the country we know that the physical structure lends itself in a marked degree to the impounding of large volumes of water, but the natural facilities for a general system of storage can only be ascertained by thorough and efficient geographical examination. And in the interests of public life and national prosperity it is most desirable that such examination be undertaken and conducted with as little delay as possible. In some of the States, notably Victoria and South Australia, the necessity for water storage and irrigation has already been recognised in a practical manner, and for many years the subject has occupied attention in New South Wales, where the waters of the Murray River and tributary streams have been gauged, the catchment areas examined, and schemes for irrigating the waste bottom lands of the basin formulated. The matter has now reached a stage which under the enlightened policy of the present N.S.W. Government is about to be demonstrated in a practical and impressive way, by the inauguration of the Northern Murrumbidgee Irrigation Scheme and the construction of an immense dam to conserve the waters of the Barren Jack catchment area, both having recently been sanctioned by Parliament. It is to a consideration of these impending National works, their bearing on the further development of the State, the advantages of irrigation and water conservation generally to Australian settlement and industrial progress, that the present observations are mainly offered; having at the request of the New South Wales Government recently assisted in the inquiry respecting these works and geographically examined the country, including an inspection of the reservoir and dam sites.

PHYSICAL.

Unlike the Murray and Darling the Murrumbidgee River lies wholly within the territory of New South Wales. Emanating from a source in the elevated tableland at the base of Peppercorn Hill, some five thousand feet above sea level, and distant a few miles N.W. from the town of Kiandra, it flows south-easterly to the left of the dividing Range. which separates it from the head waters of the Snowy

River, to a point about five or eight miles in a north-westerly direction from the town of Cooma. In consequence of the somewhat remarkable *cul de sac* configuration of the Main Coast Range and great Alpine chain of the Victorian Cordillera, the river is here deflected for probably one hundred and twenty degrees and taking at first a northerly course runs for some considerable distance parallel with the Goulburn-Cooma Railroad, from which it trends north-westerly to its junction with the Yass River. Down to this point the Murrumbidgee receives the Umaralla, Bredbo, the Molonglo and other important tributary streams, and traverses a tract of country possessing some remarkable features of great natural beauty, especially at the head waters, where the mountain spurs are steep and rugged and the lateral valleys deep and precipitous. The catchment area of this region, in the Counties of Beresford, Cowley, Murray, and Buccleugh, and comprising the famous tableland of the northern Monaro district, and the basin of Goodradigbee Creek, is about five thousand square miles. This is mentioned now, as the matter will enter somewhat largely into the discussion of the subject later on. From the Yass River junction the Murrumbidgee strikes westerly, and flowing through the famous Riverina district is joined by the Lachlan River, below Hay, and farther down is united to the Murray River at Balranald ; the total length of the stream to this point of union being 1,350 miles. From its source to the Cooma bend, 170 miles, the average fall of the Murrumbidgee River is about 11 feet per mile, then down to the Yass junction the gradient is lowered to 4 feet per mile, and on to Narrandera to 2 feet per mile.

The lower section, of some 470 miles, between this last place and the Murray junction, has but a slight fall of barely 9 inches per mile, which circumstance favours the inundation of extensive areas of the bottom lands of the basin, when the river is in high flood. The official estimate of the yearly flow of the River at Narrandera is as follows :—

4,000,000	acre feet in a	flood year.
2,000,000	,, ,, ,,	fair year.
1,000,000	,, ,, ,,	dry year.
603,000	,, ,, ,,	year such as 1902.

These results are, however, inconclusive, obtained as they have been from rather insufficient observations, covering but a comparatively short period of six years, during which time the River was systematically gauged.

HYDROGRAPHICAL.

Geographically considered these physical conditions naturally belong to three distinct hydrographical divisions of the river basin, in which corresponding changes in the geological structure of the

region occur. The first of these divisions includes the head waters, covering an area of some five thousand square miles, and comprising the catchments of the river and tributary streams, down to the junction of the Goodradigbee Creek, as previously mentioned. For descriptive purposes this may be referred to as the Upper Region or Barren Jack catchment. Here the hydraulic gradients are steep, the declivity of the water channels being sharp and the numerous tributary streams when flooded are consequently rapid and torrential in character, cutting deep into the rocks and soils, whilst their lateral erosive action augments the sedimentation of the waters and contributes to the fertilisation of the lands lower down.

OROGRAPHICAL.

The Orographical features of this Upper Region are chiefly represented by a circumscribing mass of mountains, the eastern side being flanked by the great coastal range, here from 2,000 to 3,000 feet high, that stretches away northerly along the whole sea-board of the continent to Cape York, and separating the waters that flow easterly to the Pacific Ocean, from the inland waters. On the south and south-west this range is united with the lofty Alpine chain of from 5,000 to 7,000 feet in altitude, whose culminating peak is Mount Kosciusko, at the head waters of the Murray and Snowy Rivers. Apart from the maginficent scenery, the panoramic views and the sublime natural beauty of vegetation, hill and dale, which here present themselves, the country is especially interesting to the student of Geographical Science, as being the birthplace of the Australian Continent. Here in the early morn of the Palæozoic period appeared an insulated mass of land, to which in the succeeding age were united other masses along the extensive eastern coast line already referred to. At the beginning of Mesozoic times the lofty summits of the mountains that were crowded together in the neighbourhood must surely have formed a magnificent picture in striking contrast to the present landscape. The range was then over 10,000 feet high, and the stupendous culminating peaks of the Cordillera would probably act as accumulators for the densely packed vapour clouds, which, no doubt, enveloped the region, precipitating their copious waters on the luxuriant vegetation of the period. The associated torrential rainfalls would sweep down and along the steep and rugged slopes of the mountains, carrying with them enormous deposits of fertile soils to the great river valleys, low lying plains and marshes below. In this manner the vast central depressions of the continent were filled up and the western plains of the interior formed by the basaltic detritus subsequently washed down in later times from the adjacent ranges

The great inland rivers which then drained the slopes of the rugged coastal ranges and emptied themselves into Spencer's Gulf were amongst the most striking topographical features of the country. But in further allusion to the Upper Region of the Murrumbidgee, it may be remarked in continuation that the physical conditions of the circumscribed inner area consist chiefly of table-land country and high plains, rising by steeply timbered ridges to the Snowy Mountain Range, where there occurs an extensive tract of treeless downs, of from 5,000 to 7,000 feet above the sea level. Here, the snow mantles the surface of the ground for half the year. The northern Monaro Plains are extensive, stretching as they do from Michelago to the range dividing the waters of the Murrumbidgee and Snowy Rivers. With the exception of small isolated patches of stunted trees the elevated area is denuded of timber and scrub, a condition no doubt responsible for the somewhat inappropriate geographical terminology, "Plains," suggesting flat or level country, when an undulating surface actually occurs, with moderately high peaks in places. Geologically these high lands are of trap formation, basaltic lavas and igneous rocks being abundantly represented over the whole region, with surface stones scattered about in all directions. There is however a thick crop of short, sweet grass, all over the plains, and this has rendered the district famous for sheep farming since the earliest days of settlement and colonisation, there being largely produced some of the fine Merino wool, for which the State has so long been noted.

GEOLOGICAL.

The geological structure of the watershed ranges already foreshadowed in referring to the Palæozoic origin and early life of the continent, as a whole, consists chiefly of ancient Silurian deposits of two periods, the lower deposit probably corresponding to the European and North American Cambrian or Laurentian formations. The granites, syenites, porphyrys and other plutonic rocks are also largely developed on most of the summit ridges of the Alpine chain, and these sometimes occur in the form of intrusive igneous rocks of a later period. But the Palæozoic formations have a wide range, being distributed over extensive areas of the continent and constituting the principal mountain masses, and the great dividing ranges. They occur in the Blue Mountains, the Pyrenees, the Grampians, and are largely developed in Western Australia, South Australia, and Queensland. To them belong the rich auriferous rocks, the metaliferous strata and the carboniferous beds which have rendered the country famous since gold was first discovered in the early days of settlement. And these ancient deposits are rich in fossiliferous remains,

a determination of whose species has thrown a flood of light on the fauna and flora of the continent during the early life of the world and enabled us to read with tolerable accuracy the history of past ages, of whose physical and climatic conditions nothing could otherwise have been known.

VEGETATION.

The vegetation of these watershed ranges of the Upper Region, including also the sources of the Murray and Snowy Rivers, partakes more of the Alpine character than the plants found elsewhere in the basin of the Murrumbidgee. The ridges are mostly timbered with belts of mountain ash and other local varieties ; but there are elevated plateau lands, locally known as the Snow Country, where tracts of treeless downs are met with, and these latter being carpeted with rich nutritious green grasses, during the summer months, are valuable pasture lands, more especially in times of drought, when stock suffers so greatly on the plains below. Botanically considered this Alpine region, reaching an elevation of 5,000 feet above sea level, and its extension into Victorian territory, possesses some specially interesting features in regard to the wide distribution of plant life and the intermingling of species common to both hemispheres of the Globe. While some of the forms are distinctly local in character and peculiarly Australian in type, there are many others corresponding to and not a few actually identical with those of the highland zones of Europe. And this remarkable commingling of terrestrial vegetation is not merely restricted to a few particular genera, but we have it on the authority of Sir Joseph Hooker that it includes many species as well, which circumstances doubtless contribute much to the singular beauty of the flora peculiar to the colder parts of this quarter of Australia, and perhaps in a lesser degree to New Zealand. But these are matters which for their further elucidation appeal more particularly to our sympathies when dealing with the geography of the continent, as a whole.

MIDDLE REGION.

The next section of the Murrumbidgee basin will be herein known as the "Middle Region," and extends down to Narrandera. It embraces some hilly and undulating country, and below the Tumut River junction extensive plains are met with, but considered in the light of a geographical unit no striking topographical or even physiographical features present themselves for special treatment.

For pastoral purposes the area under consideration is eminently adapted, but although some patches of alluvial deposits occur at the junctions of most of the tributary streams such lands are usually too

limited for extensive agricultural operations, without the aid of some fertilising agent.

The prevailing geological conditions are here represented by a wide distribution of Lower Palæozoic strata and the occurrence of plutonic rocks, the granites being developed over fairly large but not continuous areas, more especially where hills form the dominant surface features of the country. But these representative formations are comparatively simple in their structure and present no complicated phases requiring further elucidation. The vegetation, too, is likewise typical of the western country, comprising the immense tributary drainage areas of the Murray River system, and is chiefly represented by the ordinary forest timber trees so familiar to the settlers since the early days of colonisation. The various gums, the bloodwoods, the stringy-barks, the iron barks and the boxes are readily recognisable amongst the forms met with and some of these are of striking proportions on the rich alluvial frontage to the river and tributaries. But the same may be said of many other parts of the continent, for there is a strange similarity about the timbered areas of South-eastern Australia, whose "bush" vegetation is characterised by the sombre and uniform colour of the foliage peculiar to the eucalyptus and the remarkable "scrubs."

LOWER REGION.

The third division of the basin will be designated the "Lower" Region, and extends downwards to Balranald, where the waters of the Murrumbidgee unite with those of the Murray. The whole area is almost devoid of orographical features and consists of extensive plains, some being over fifty miles across, and treeless in many places. This is especially so in the case of the "Old Man Plain," adjoining Hay on the south and the "One Man Plain," between Hay and Booligal, both of which sustain patches of saltbush, scattered clumps of stunted trees and nutritious herbage, on which the numerous flocks of the district flourish, the locally grown wool having acquired a favourable reputation for both quantity and quality.

The geological character of the country differs greatly from that of the two preceding regions and is represented by a wide distribution and development of Tertiary rocks, and these are distinguishable by the three formations, Pliocene, Miocene, and Oligocene, in which the strata occur. This Tertiary group is widely distributed over the whole lower basin of the Murray River system, extending into the south-western parts of Victoria, and terminating at the Ninety-Mile Beach, along the shores of Encounter Bay, on the west, and the mouth of the Glenelg River on the east. But there is an interruption to its

continuity along the Victorian seaboard, by the occurrence of Primary and Plutonic rocks, notably the granites, which are, however, not developed as a continuous formation along the coast line, but rather in detached masses.

In considering the geographical conditions of this region as a whole we are led to the conclusion that the Tertiary formation owes its origin to the river drifts of the Murray system that have accumulated for ages on the floor of the basin, gradually filling it up, from remote times, to the present level. And this also furnishes an example of the formation of river valleys, deltaic areas and alluvial plains, showing a result of the intense erosive action of water on the solid crust of the earth and standing as an object lesson in the process of reclaiming the great central depression of the Continent, since the disappearance of the Cretaceous sea.

CLIMATE AND RAINFALL.

We are now brought to a brief consideration of the climate and rainfall of these Murrumbidgee areas, their influence on settlement, vegetation, and animal life generally. From the preceding remarks on the orographical features of the basin it will be readily concluded that between the upper and lower regions the most diverse climatic conditions exist. On the mountain ranges and high tablelands of the former there is a low temperature almost all the year round, the winter colds being severe, and in places the snow is heavy but not perpetual and does not remain so long unthawed as at the head of the Murray, where, in the higher parts, the shaded slopes may not be altogether uncovered for more than once in every ten years. On the northern Monaro plains and neighbourhood there are long and cold winters and even in summer the temperature occasionally falls to freezing point, when crops susceptible to the influence of frosts may suffer. But on the whole the climate is delightfully healthy during the summer and autumn, when out-door life is most enjoyable, the conditions of local environments being certainly superior to those of the Dalgety area, to the south-west, which is lacking in some of the more essential geographical elements to recommend it as a first rate site for the Federal capital, as suggested by the Commonwealth Parliament. At Cooma, on the elevated plains, 2,636 feet above sea level, the mean temperature is fifty-four degrees and the range falls from a maximum of 107 degrees to a minimum of twelve degrees. but over the whole of this tableland country the mean thermometer reading may be taken at about fifty degrees Fahr. throughout the year, and the rainfall twenty inches. But at the sources of the Murrumbidgee and Tumut waters the isohyetose lines of 50 and 60

inches denote the greatest pluvial measures that occur in the district, while the hyetographic conditions of the remaining portion of the Barren Jack Catchment, or Upper Region, may be put down as varying from 20 to 30 inches. Passing on from here the temperature increases and the rainfall diminishes with the descent of the river, until the lower section is reached, where we find from 12 to 18 inches of the latter ; and in the Middle Region, from 18 to 20 inches, with moderately high summer temperature and cold winters. But in the Lower region the extremely dry heat of the summer is intense, the mercury sometimes rising to 110 degrees and 120 degrees in the shade and the range is correspondingly great, for in winter it falls to freezing point. But on the whole it may be noted that for some eight or nine months of the year the climatic conditions are agreeable, the winter season being delightfully bracing and eminently favourable for consumptives, or those who suffer from respiratory troubles. Settlers are however chiefly concerned about the rainfall, which for most economic purposes is uncertain and deficient, especially so during the occurrence of droughts, whose disastrous effects are not wholly unknown in many other parts of the continent, the only possible remedy being the systematic conservation of water.

EVAPORATION.

This now suggests a reflection on the important subject of evaporation and its influence on large storage supplies of water. It is a matter to which I may fairly claim to have given much attention, chiefly because of its important bearing on the rainfall and surface waters of the country, as well as for the desire to ascertain the reason upon which so many diverse opinions have been advanced by a host of investigators. My own views thereon have been very fully expressed elsewhere and are set forth in detail in the literary transactions of the Royal Geographical Society of Australasia, Queensland. They embody the results of careful and extensive investigations, covering many years of actual research, and, stated briefly, are to the effect that in every instance examined, the loss by evaporation has been greatly underestimated. This is especially so in the case of artesian supplies, whilst the Evaporation observations on the waters of the Murray river system, are inconclusive, as they have been made under circumstances in nowise conforming to the natural conditions obtaining. Experiments made on purely artificial data or on the surface of a lake, whose entire sources of supply or means of loss are unknown, or at best merely conjectural, must, in the nature of things, have little scientific value, and may, as likely as not, be actually misleading. In any case a closer approximation to the truth is more likely to

be obtained by assuming that the amount of water lost by evaporation under existing conditions is probably fifty per cent, greater than generally estimated, and on the western plains it is certainly more. At Walgett, the yearly evaporation is said to be 65.494 inches ; at Wilcannia, 68.976 inches ; and at Dubbo, 71.504 inches ; these results having been obtained from observations extending over a period of ten years, from 1st January, 1893, to 31st December, 1902. It would therefore be wise to keep these in view when formulating any scheme for the conservation of water and its application to economic purposes, whether for raising power, irrigating land, or merely watering stock. Especially should these results be borne in mind in utilising the waters of the Murrumbidgee River for fertilising the lands of the Lower Region, where local conditions favouring rapid and excessive evaporation exist in the highest degree, and are probably little inferior to those obtaining in the arid plains of Central Australia, on which the finger nails break off in brittle pieces under the influence of excessively dry air. As illustrating the widely different views on this subject it is only necessary to refer to the evidence adduced at the sittings of the Royal Commission on the conservation of water in 1884, in which certain values are assigned to the results of experiments conducted by qualified observers in New South Wales and elsewhere, under varied conditions and circumstances. And, again, to the masterly summary of such evidence, in which the Commissioners are careful to emphasize the fact that " in the present state of our knowledge upon the subject, opinions vary considerably." They might have gone further and added with equal clearness and cogency that existing experimental methods and appliances are inadequate and calculated to give erroneous results, the tank system being to my mind one of the most unsatisfactory methods adopted, and one whose obvious defects are dissimilar to the natural conditions of a moving liquid mass or even a liquid body at rest. In a comparatively young country like Australia this matter has as yet received but little consideration at the hands of those chiefly concerned and yet it is of paramount importance in all enterprises where the economic utilisation of water enters. For in possessing a knowledge of the quantity of water evaporated from a given area, we are not only furnished with information concerning local winds, temperature and surface conditions, but we are armed with material of great value in the construction of storage reservoirs and irrigation canals, so as to limit the exposed surface areas as much as possible, thereby affording the greatest protection against loss, which in hot and dry localities must obviously be considerable, even after making all due allowance for exaggerated reports and faulty observations.

ECONOMIC.

The economic or industrial phase of the subject of this paper having now been reached it becomes possible in the light of acquired knowledge by our geographical exploration of the area under consideration to make an intelligent examination of the facilities afforded for the systematic utilisation of the Murrumbidgee waters. In doing so we must first of all remark upon the evidence of the impermeability of the strata of the Upper Region as revealed by a study of the physical structure of the locality, and the favourable conditions which exist for the storage of large supplies of water. We have furthermore shown that the climate is excellent and the rainfall abundant, while in other respects the area forms one of the best catchments to be found in the whole of the State. It is drained by several important streams of steep declivity by which the waters from the melting snow on the lofty ranges and the annual rains are rapidly carried to the lower regions of the basin before suffering any serious loss from local causes. The sources of supply are singularly free from the contaminating influences of physical conditions, and there is no probability of immediate failure through deficient precipitation during normal seasons, augmented as the supply naturally is by periodic snow falls on the higher levels. With the exception of the Tumut River drainage and some minor streams, this Barren Jack Catchment includes the whole of the contributing area of the Murrumbidgee basin, and owing to the natural configuration of the country the gathering ground is singularly circumscribed by an annulating rim of impermeable rocks, which greatly contributes to the successful storage of immense supplies of water and renders the construction of retaining dams possible. In no other basins of the continent do we find greater natural facilities for impounding a large percentage of the rainfall and nowhere else are the associated geographical conditions more ideal in their character, more diversified in their scenery or more typically Australian in their vegetation.

DAM SITES.

In determining the feasibility or otherwise of conserving the waters of this catchment, the question of suitable dam sites requires careful consideration. As a result of detailed examination by officers of the Public Works Department some three localities have been suggested as affording natural facilities for the construction of dams, the site known as Barren Jack being finally selected. This is situated about three miles below the junction of the Murrumbidgee and Goodradigbee rivers, and distant some twenty-one miles S.W. from Bowning, on the Great Southern Railroad, where the river has

cut a deep gorge through the ridge of granite rocks that lies across its course affording natural facilities for impounding immense quantities of water. Here we have an example of the erosive and disturbing action of great volumes of water when confined to the narrow channel of a stream of steep declivity, illustrating in a marked degree the life history of a tributary river flowing through mountainous country. Like many of our Australian watercourses, the Murrumbidgee is but a miniature stream, so to speak, compared with its former majestic proportions, when two or three hundred feet above its present level and spread out over a channel of probably not less than a mile across from bank to bank. In the comparatively narrow gorge between Barren Jack Mountain and Black Andrew the torrential waters and floating ice masses of past ages have left their indelible imprint on the broken and distorted granite masses that are scattered about in all directions or piled together in disordered and confused heaps everywhere.

Geographically the locality is bold and rugged in its topography and the true character of the rock structure is obscured by the chaotic condition of the river channel through the granite formation. Exposed for ages to the influence of the elements the sides of the gorge have thrown off great masses of granite blocks that are fractured and broken up into all shapes and sizes as they rest on the precipitous slopes or in the bed of the river, concealing the true structural character of the underlying strata. Lithologically considered the exposed boulder granite rocks are not of an especially good texture, the grain, though fairly fine, not being exceptionally compact and dense. They belong to the Palæozoic series of plutonic rocks so largely developed on the watershed ranges in which the river has its rise and are not merely of purely local occurrence, but form a continuation of the great system of Silurian strata to which former allusion has been made. Associated with this granite formation in the circumscribing ranges of the watershed are other porphyritic igneous rocks of the Palæozoic age, whose impermeable nature would form an effectual barrier against the loss of impounded waters, rendering the locality an ideal site for a storage reservoir.

Three alternatives were at first suggested for the construction of a dam at Barren Jack, the intention being to raise the barrage in stages of 120 feet, 170 feet, and ultimately to the full height of 200 feet, which would have spread out the time of construction over a period of seven years from the 120 feet stage. But of this proposal I was not in favour, strongly recommending on scientific and professional grounds that the work should be carried on from start to finish without any stoppage. It was finally decided that the dam

should " be constructed to its full height, 200 feet, the work of construction to proceed continuously to completion," the estimated cost, including land resumption and protective works, being put down at £810,000. With a dam of this description the reservoir capacity will be 33,380,864,000 cubic feet, and the water area no less than 20 square miles, the Murrumbidgee River being held back for a distance of 40 miles, the Goodradigbee River 15 miles and the Yass River 24 miles from the dam site.

It will generally be considered that the proposal to carry the dam to a height of 200 feet is extremely bold as an engineering enterprise in a country where experience is not ripe and all undertakings of the kind must for a long time to come be purely experimental in their more essential characteristics. In a country like America the idea would present no novel features of importance, but to the British mind the case is somewhat different and in reporting on the scheme I was obliged to plead for the lower grade of 150 feet, which in my opinion the height of the dam should not exceed. It was pointed out that the impounded water area of the Barren Jack Reservoir will be more than one and a half times that of Sydney Harbour, the storage capacity being little inferior to the great Assuan Barrage of the Nile, while the hydrostatic pressure at the base of the dam will be dangerously high and destructive to the works should any flaw be discovered. The fall of the river and height of dam are greatly in excess of those at the Nile Barrage, where the slope of the ordinary channel for some seven hundred and seventy miles upstream is only about 5 inches (1/12000) per mile, against as many feet in the Barren Jack Area. The exposed liquid surface of the reservoir will be highly favourable to maximum loss by evaporation in a locality such as the Middle Murrumbidgee, where the summer temperature is fairly high and the percentage of humidity low. And it will also be readily understood from the comparatively steep declivity of the river and from associated local conditions that the velocity of the water through the dam sluices will be very great when the reservoir is full, rendering extreme caution necessary in such a gigantic enterprise, bearing in mind the lesson afforded by the construction of similar works on the Nile, to which incidental allusion has been made.

From a detailed exploration of the Murrumbidgee River it was found that besides the Barren Jack site there were two other places higher up the stream where the natural facilities were favourable to the storage of water. The remotest of these is located at a place where there is a deeply eroded channel through the rocks forming the bed of the river, about 10 miles N.E. of Kiandra. Here the con-

struction of a dam 125 feet in height would impound a considerable body of water of an estimated volume of about 216,200 acre feet, representing the drainage from a catchment area of 128 square miles of high mountainous country, noted for heavy snow-falls and copious precipitations. The other site is below the junction of the Murrumbidgee and Umaralla rivers, some twenty miles north of Cooma, where the occurrence of a rocky gorge would facilitate water storage. But here under existing conditions of railway improvements and bridge works the height of a dam would be limited to 60 feet. This however would not hold back sufficient water for the purpose of flooding the available lands in the Lower Region, where irrigation works are to be inaugurated as part of the State Scheme under review, and to which some attention must now be given.

From our knowledge of the geographical conditions of this region we are enabled to delineate the characteristic features of the country and to allude to the aridity of most of the area. From the low rainfall of less than 20 inches it must be evident to any intelligent person that, in their present natural state, the lands for all practical purposes are arid and of no commercial value. But the soils would readily respond to the fertilising influence of artificial watering from storage dams higher up the stream, and the Departmental Scheme under consideration is calculated to bring about an entire and greatly needed change in the economic utilisation of this area. The summer thermometer readings are usually high, although on the whole the climate is delightfully genial, but the district thirsts greatly for an adequate water supply for the development of its agriculutural industry, and until this natural craving is satisfied the rural settlement of the locality must necessarily be much restricted. Between Narrandera and Hay there lie on both sides of the river, two fairly large irrigable areas, comprising on the north side some 750,000 acres and on the south side 912,000 acres. But for present purposes the former of these has been selected and in this section the Government proposals are based upon an area of 196,000 acres of first class lands and 162,000 acres second class land or in all 358,000 acres for operative purposes in connection with the storage waters of the Barren Jack reservoir. For diverting these waters from the main channel of the Murrumbidgee to the service canals a weir and regulator will be constructed at a granite bar near the Bundigerry Creek junction, about nineteen miles above Narrandera, and from this place downwards to the terminal point the supply will flow through a course of 132 miles from the offtake. Including weir and regulators the final estimate for artificial channels or service canals, is £764,008, which being added to the former amount put down for the Barren

Jack dam and protective works, will bring up the total cost of the scheme to £1,574,008. The diversion site above Narrandera has been selected in preference to any other suitable locality lower down the river, as commanding the largest possible area of irrigable country, as affording the opportunity of utilising the storage waters to the best advantage, to increase the reticulation gradient by diverting the waters from a higher level, and, as Mr. Lee, the Minister for Works, so ably and tersely puts it, "to get the greatest result possible from the proposed expenditure." With this view I entirely agree. But at the same time the fact must not be overlooked that the length of service canalage will be in proportion to the distance of the offtake from the storage site, and that the loss of water by evaporation, soakage and other contingent causes will be increased in proportion to the extent of country traversed and the distance from the diversion weirs to the fields.

In the scheme under consideration this will likely be considerable not only in the earlier operative stages but even when fully matured, unless the canals are lined or the water is transmitted through wooden or metal troughing. In any case it will be a difficult matter to minimise the loss caused by evaporation in a climate like that of the Riverina district, where the temperature is high and the air exceedingly dry.

IRRIGATION GENERALLY.

I should now like to offer some remarks on irrigation generally, as understood and carried out in other parts of the globe, my own personal observations during a recent tour of the world enabling me to do so with greater facility than would otherwise be the case. Irrigation, it may be remarked, is the fertilisation of land by the artificial distribution of water over its surface. It is necessary for agricultural purposes where there is irregular or deficient rainfall, or in places where the rains do not fall when most wanted. This occurs in many parts of the world and even in tropical countries the cultivated soils sometimes require to be vitalised by the application of water from perennial sources, otherwise the crops would fail. The idea of artificially flooding the land for the purpose of crop raising goes far back into antiquity. In Asia and in some parts of Europe it found practical expression centuries ago, and even among the primitive races the art of utilising the waters of local streams for enriching garden and plantation soils has been long known and is practised to this day in many places of the world. This is notably the case in the islands of Polynesia, Melanesia and Micronesia, where irrigation in its simplest and most original form enters into the economic conditions of life to an extent not usually known in many

countries where it is far more needed and where, moreover, the greater advantages of enlightened civilisation lend themselves to wider developments and more profitable enterprises in agricultural industries and to a higher appreciation of the value of an adequate water supply. One of the earliest forms of irrigation consisted of raising river, lake or well water by hand and pouring it on the land. In Egypt this was done centuries ago, when the water was raised by a bucket suspended to the short end of a long pole fixed to a moveable axis and balanced at the opposite end by a heavy weight. By these means the water was raised some fifteen or sixteen feet to the land and even now the numerous small fields that are scattered along the banks of the Nile are watered in the same way. And in northern India the primitive shallow bucket suspended between two strings is used to raise water on to the cultivated fields, where remarkably good crops reward the industrious cultivators, who in the absence of this method of fertilisation would be forced to abandon the land and seek some other means of living. But the broad alluvial plains of fluviatile valleys afford greater scope for the development of irrigation works on more modern lines as well as for the accomplishment of large undertakings, according to approved methods, and the inauguration of vast industrial enterprises, for the economic utilisation of river waters. In Italy for instance the plains of Lombardy and Piedmont afford a striking example of the results of high class irrigation and furnish an object lesson in which every variety of conditions is fully illustrated. Unlike the primitive Polynesians, who divert their river waters at suitable places and carry them on to their plantations by the remarkably effective means of bamboo piping and open ditches, or the Nile peasant, who raises by his counterpoised Shadoof enough water for the fertilisation of his four acre holding, or the Coolie, with his comparatively modern water wheel, the Lombardy farmers have profited by long experience and aided by the best class of engineering works are enabled to utilise the abundant supplies derived from the River Po, the lakes Maggiore and Como, and other great sources to the best advantage. But this is the result of generations of experiments and extended enterprises in a country where the melting Alpine glaciers and snow fields augment the great torrents of the Dora Baltea and Sesia and render the water supply inexhaustible and regular. Then again, we have another interesting example of vast supplies as furnished by the Ganges, the Jumna, and the great Punjaub streams, used for watering the extensive plains of northern India, where irrigation is met with on a gigantic scale. And in Southern India too, there are, besides the three great streams draining the Ghats, a series of large reservoirs and tanks whose waters

are carried on to the land by a system of canals quite adequate for all local requirements. There is no other country where irrigation is carried on so extensively as in India and in no other part of the world are the facilities for successful works of the kind so great. In many of the native States tanks and dams are scattered about in all the valleys and in the territory of Mysore alone there are no fewer than 40,000 reservoirs, the physical conditions of the country being highly favourable to the construction of such. But for gigantic undertakings having for their purpose the conservation of water on a scale unsurpassed in any other part of the world, we must go to Egypt and study the Nile Barrage as well as the great Assuan Dam and Reservoir, which were recently opened with imposing ceremonial and whose completion within the incredibly short time of four years has astonished the world and marked another triumph of British engineering, enterprise, and genius. The stupendous nature of this great impoundage scheme, whose chief object is the perennial irrigation of the lands of Upper Egypt, thereby enabling the agriculturist to grow two crops a year instead of one, as formerly, can hardly be realised by the presentation of a series of figures representing the dimensions of the undertaking. But it is interesting to note that the massive granite structure forming the dam across the valley is 6,400 feet long, 82 feet thick at the base and 23 feet at the crest, the whole solid wall rising 130 feet above the bed rock of the river. The capacity of the reservoir, which is 66 feet deep and extends for more than 100 miles up the Nile Valley, is 38,000 million cubic feet of water and the Nile flood is passed through 180 sluice gates in the dam, capable of discharging 360,000 cubic feet per second. The entire works will command 450,000 acres of irrigable basin lands, and when completed the whole scheme, including the minor dam at Assiut and distribution canals in Upper Egypt, is estimated to cost six and a half million pounds sterling.

And we have it on the authority of Sir C. Scott Moncrieff, to whose most recent writings I am indebted for these statistics, that this will have the effect of increasing land rental by about £2,637,000 and the market value of the land by £26,570,000. But this is not all and we must take into account the far reaching influence of such remarkable developments on the general prosperity and industrial life of the territory as a whole. And it must be borne in mind that this influence is not wholly represented by the increased local values to which we have alluded, but there are other sympathising and susceptible elements that have to be noted when considering the scheme in the light of its effects on the country at large. Although of comparatively recent date irrigation in the new world has

already assumed colossal proportions, and in the Western States of America vast areas of waste lands have been reclaimed and are now occupied by enterprising and industrious cultivators. At the present time the area controlled by elaborate systems of irrigation there is probably not less than 10,000,000 acres, and these lands, which formerly were not worth more than from 10s. to 20s. per acre have now risen to £8 10s. per acre.

Although timber enters somewhat largely into the calculation of the American engineer there are many of the water works conceived and carried out in the United States on bold and liberal scales, which far surpass any undertakings of the kind in the Old World. But America is a progressive country, where vast tracts of arid lands afford wide scope for the development of great enterprises, and the people there are not slow to recognise the immense advantages of an adequate supply of good water for the fertilisation of the soils. With them the average cost of bringing the water on to the land is about 32s. per acre, and the farmer is charged a water rate of from £2 8s. to £4 per acre, with an additional payment of from 2s. to 10s. per acre yearly, to cover the expense of maintenance. The cost of service canals vary from £100 to £150 per mile, the former being for a channel 5 feet wide and the latter amount for one 10 feet wide. Having briefly alluded to the progress of irrigation in countries where the economic utilisation of storage water is necessary to the industrial prosperity of the people, I will consider for a moment the comparative conditions under which such works have been established and the possibility of similar enterprises being carried on profitably in Australia.

In Egypt the rich deposit laden waters of the Nile, which rise and fall with never-failing regularity and are unapproachable in their fertilising elements, render the source of supply certain and therefore of the first importance for irrigation requirements. It is in such a country where the lands may be irrigated to the highest state of perfection, and that such is actually the case may be inferred from the fact that in the neighbourhood of Cairo agricultural holdings when put up for sale fetch as much as £150 per acre. In Italy, and in India as well, the source of supply is for all practical purposes unlimited and this, combined with highly favourable physical conditions for the storage of water and its diversion for economic purposes, renders irrigation possible on such elaborate and extensive scales as in other less favoured countries would not be feasible. In the former country the great rivers and lakes whose precious waters have so wide a fertilising influence on the thirsty plains of Piedmont and Lombardy are fed by the Alpine glaciers and melting snows that

have accumulated for ages on the lofty mountain ranges to the north. And the mighty streams of India, rendered famous from time immemorial, are no less remarkable for the immense volumes of water that are brought down in flood seasons from the stupendous Himalayan chain, whose perpetually snow clad and glaciated summits are inexhaustible feeders to the vast drainage systems which spread themselves out in all directions like a net work over wide territorial areas. From these a never failing supply is derived supplemented as it is by the copious tropical rains that fall in torrents over the foot hills and slopes of the lofty ranges in which the rivers have their origin. And these are actual geographical conditions, which must not be overlooked, for their importance can scarcely fail to leave an impression on the thoughtful mind, to such an extent as to arrest attention and induce consideration, especially by all whose duty it is to contemplate the subject of water conservation for irrigation purposes or other industrial needs. They point conclusively to the fact that for any system involving the extensive economic use of water the countries under reference are immeasurably superior to the Australian Continent, considered as a whole. And even if we go to America similar conditions exist. In summarising the results of a recent tour round the world in 1903, I had occasion to allude somewhat briefly to this same subject, and as my views since then have undergone no change it may be convenient to restate them in so far as they refer to the New World · "In America . . . . we meet with vast mountain systems that spread themselves out in all directions over the whole Continent, greatly influencing the climate and materially affecting the conditions of settlement. For many months of the year these lofty regions are covered with snow, which, melting by the heat of a midsummer sun, gives rise to numerous rivers, whose permanent waters, flowing in winding channels over vast low-land tracts, are a never failing source of supply to such industrial systems as have for their object the reclamation of arid lands. Suspended on the troubled waters of these mighty streams are the sediments of disintegrated rocks and soils, whose fertilising influence upon the alluvial areas of river valleys has been recognised from time immemorial. The physical structure of the country also lends itself readily to the impounding of these waters and to the construction of service canals for irrigating large agricultural areas. These conditions, then, obviate the necessity of depending upon an uncertain and irregular rainfall, as well as of the construction of vast storage reservoirs, whose exposed waters under the influence of an extremely dry and hot climate would constantly diminish by evaporation and in times of drought probably disappear altogether. They also con-

tribute greatly to the financial success of irrigation systems by facilitating the work of construction and rendering more permanent such undertakings when complete. And it may also be added that the natural surface grade of much of the arid lands of the country is such as to greatly facilitate the distribution of water over immense areas. From the preceding remarks it will be seen that the source of supply is practically unlimited, which must necessarily contribute in a considerable measure to the success of irrigation in the United States of America. Many of the rivers are fed by the melting snows that must always remain a permanent feature of the high mountain ranges there, whilst other streams traversing warmer regions are loaded with the waters of copious rainfalls. These conditions are mostly absent in the interior of Australia, where the rainfall is so irregular and uncertain. In the coastal districts of the Australian Continent the rivers are, as a rule, short and rapid. And in the inland regions the streams carry very little water except in times of flood, and their channels are not usually suitable for the purpose of large storage reservoirs. In the basin of the Murray River and its tributaries the conditions are somewhat different, and altogether more favourable for the irrigation of extensive areas. The melting snow of the great Alpine cluster of rugged mountains in which the river has its source contributes largely to the permanency of that important stream and affluents, from which a never failing supply of good water could be obtained for reclaiming the arid lands of the valley below."

Now, in as brief a manner as possible I have endeavoured to contrast the irrigation conditions obtaining in Europe, Asia and America with those in the Australian Continent and to show how vastly the former differ from the latter. In point of fact the difference is for all practical purposes as wide as the hemispheres in which they occur, and the realisation of this is only rendered possible to the mind familiar with the physical geography of the world and its important bearing on the economic life of the entire globe. And touching upon this phase of the subject suggests to me the necessity of striking a warning chord and of pleading for a purely local consideration of the matter under discussion. Why should we not strike out on original lines and evolve something distinctively Australian in character, suitable to the requirements of the country ? We can never hope to be considered worthy representatives of the British Race so long as we are content to imitate others in the industrial affairs of life And this is really the position into which we seem to be drifting. The growing tendency appears to be the desire to inaugurate some borrowed working system, some idea, as it were, and then back it

up with piles of foreign illustration, an array of expert opinions, and more or less relevant material, when the probabilities are that such a thing is not at all suited to our local conditions and consequently could never under any circumstances be successful. It is at once admitted that the American irrigation works are bold and progressive ; that in Italy a high class system of water control has been evolved through generations of experience, and that in India the conservation and utilisation of water is carried out on a large scale to the manifest advantage of the Empire. But it would be the height of folly to attempt anything of the kind on similar lines in Australia and no man with a mature and comprehensive knowledge of the wide geographical conditions of the Continent would think of advocating or approving of such. In point of fact my personal investigations have convinced me that no human enterprise can possibly establish any system or systems of water conservation in Australia to compare in magnitude with works of the kind in the countries to which I have alluded, and that any attempt at imitation will prove a failure. Indeed it seems perfectly clear to my mind that the failure of the Mildura scheme in Victoria was in no small measure due to too much of the American idea and too little of Australian experience, combined with inadequate geographical knowledge. This, then, suggests to me the necessity of urging that the subject be considered in all its essential bearings from the LOCAL STANDPOINT. And such consideration must be based upon purely geographical and professional data, without reliance upon the experience of other countries at all. We shall be then laying the foundations of extensive local enterprises, of good reputations and of national greatness, and we shall, moreover, be contributing to the material prosperity and future welfare of the country in its widest sense. This is a matter whose bearing is so important and so essential to the success of the scheme under consideration that a justification cannot fail to be recognised for the special emphasis to which it is hereby subjected.

Now, in sounding a warning note, so to speak, against the folly of undertaking gigantic irrigation projects in this country with the idea of following the example of America, say, or India, it must not be understood for a moment that water conservation is impracticable in Australia. As a matter of fact the case is quite the reverse, for not only is it possible and feasible to store vast quantities of water for irrigating small agricultural areas and fruit plantations along the continental seaboard, but all the coastal districts possess more or less adequate facilities for water storage and in the basin of the Murray River and tributary streams the conditions are eminently favourable for extensive irrigation works. But there are few other places about which

so much can be said. Still, no animal should ever be allowed to perish from thirst, while there exist ample means for conserving a portion of the rainfall that annually runs to waste, and no arid lands should find a place on the map where they can be watered and profitably utilised. As a matter of fact the losses sustained through the death of stock during periods of drought are infinitely greater than would be the outlay for preventive measures in the shape of adequate systems for the conservation of water. And in this respect I may say at once that I entirely disagree with those who hold that it is not possible to make any provision to minimise or prevent such losses.

We are told that from 1895 to the end of 1900 there have been lost in the State of New South Wales alone some "twenty-five millions of sheep by starvation, in addition to the death of all the natural increase during a period of six years, which in good seasons would have amounted to about twenty millions of sheep more." Now taking the average price of each sheep as, say 7s., this would mean an actual loss to the State of over fifteen million pounds sterling, within the time specified, which would more than cover the cost of storing an adequate supply of water in all the pastoral districts of the State and leave an ample margin for working expenses. And the same may indeed be said of all the other States of the Commonwealth where the losses in stock during prolonged droughts are enormous. It is not for a moment contended that there should be a widely extended and progressive movement having for its main object the irrigation of pastoral holdings throughout Australia. But there is no reason why there should not be developed a system of water conservation sufficient for the requirements of starving stock in times of prolonged drought, so as to prevent disastrous loss and obviate the necessity of importing our local meat supply at such periods and afterwards restocking the whole of the country at great expense and hindrance to trade. In the arid regions of the New World it is not uncommon to grow food for stock on irrigated lands, and numerous fields of Japanese clover, met with in travelling recently through America, afforded sufficient evidence of the success of the industry. It is usual to take four crops a year of this drought resisting fodder plant off those specially fertilised areas, the yield being from six to eight tons per acre and there is no reason why similar results should not be obtained in this country, where the soil and climate are even superior. Then there are the agricultural interests of the States to be considered and these are of wide and far reaching importance. And in this connection it is necessary to pause and think how much better it would be for all concerned if Australia were in the same position as, say, California, with her splendid fruit supply, and other products of system-

atically irrigated lands. Nor is it possible to overlook the important bearing of such matters on the industrial life and general prosperity of the entire Commonwealth, which must acutely feel the injurious influences of recurring disastrous droughts, so long as no provision is made to minimise their widely felt effects.

There is no doubt at all that a great deal of the agricultural lands lying within the coastal districts of New South Wales and Queensland could be fertilised very considerably by conserving a portion of the rainfall that now finds its way through numerous river channels to the sea, and is entirely lost to the country which so much needs it. It is not for a moment supposed that this idea of water conservation is applicable to every stream along the whole seaboard of these States, as there are places where, from my own personal knowledge, the local physical conditions would render the establishment of storage works out of the question. But on the other hand it is known that some of the streams afford good facilities for impounding water, and these should be fully utilised. And, indeed, the same may be said of most of the coastal districts of Australia; where lands are suitable for agriculture. Besides the Murrumbidgee there are in New South Wales the Murray and Lachlan rivers, both of which afford important facilities for the storage of water on a large scale, the former being without doubt the greatest of all our antipodean streams, from the economic standpoint ; although of comparatively little value as a means of direct communication between the sea and the interior, in consequence of an obstructed outlet.

In Queensland there are several coastal rivers whose waters would be of immense advantage to the industrial life of the State if systematically conserved and economically utilised for the irrigation of agricultural areas and the watering of stock during abnormally dry seasons. The great drawback with some of our Australian rivers is insufficiency of water. In flood times the supply is greatly in excess of the demand, but during protracted droughts the streams fall very low and could probably not be depended on for extensive irrigation. Still in many of the more permanent channels immense volumes of water are allowed to run to waste yearly, instead of being used to fertilise the lands where they are so greatly needed or to keep alive the vast numbers of sheep and cattle that perish from thirst.

The first step in the direction of water conservation is to systematically gauge the rivers, explore their basins and locate suitable dam sites. And as this is the work of years, no time should be lost in making a start for it is necessary that the discharge of the streams should be known in seasons of least rainfall as well as during times of flood so as to ascertain the minimum quantity of water available for industrial purposes.

As the work involved will necessarily be expensive and some time must elapse before any return on the outlay could be expected, I would suggest the establishment of a water rate to be levied on all property holders who may reasonably be expected to benefit by the storage of water, and that the revenue derived from such rate be set apart exclusively for the purpose of having all our promising or likely rivers thoroughly explored hydrographically and a system of gauging established, with the view of instituting irrigation works in suitable localities, where the water supply is found to be adequate. And this can only be ascertained by detailed examination of available data, such for example as rainfall, the loss occasioned by evaporation and other causes, the physical condition of the catchment areas and of the channels. But the work of obtaining this information should be put in hand at once, as it will take many years of patient and careful labour to collate sufficient reliable workable material for the establishment of any extensive system of irrigation. The professional men now employed in the State could do all that is necessary in this matter, as expert service would not be required for a long time to come, when all the preliminary investigations would be mature and the required data available for special treatment.

For irrigation to be successful in Australia, or elsewhere for that matter, the water should be under direct State control and the whole enterprise of distribution and utilisation, if in the hands of the Government, should be conducted on strictly business lines. The initial expense of introducing irrigation into a country is usually great, and as a rule there must necessarily be some time of unprofitable labour in preparing the lands for cultivation. Then there is the difficulty and delay involved in settling people on the areas to be watered and many obstacles to be overcome before there can be any adequate return on the original outlay. But, on the whole, it is desirable that the system of co-operation should form the basis of any movement for the reclamation of arid lands. There is, for instance, nothing better than the results achieved by the Mormons, whose co-operative system in the State of Utah is a monumental example of a magnitude unequalled elsewhere. And this illustration, combined with other less notable though equally successful experiences, suggests the recommendation that all industrial undertakings of the kind should be carried out by private enterprise, the water supply alone being provided by the State, on payment of a fixed scale of charges.

There is no doubt whatever that a great future lies before the Commonwealth, if practical steps be taken to conserve water; to reclaim the waste tracts of the inland districts, and to render more fertile and profitable some of the poorer agricultural areas of the

coastal regions. The effects of such an enlightened policy on the part of the Authorities would do more to encourage private enterprise; to bring about a lasting prosperity to the country at large, to settle people on the land, thereby increasing the rural population, to restore the confidence of investors, and pave the way for successful immigration, than anything that has ever happened since the discovery of gold and the establishment of representative Government. This is a bold statement, but to those who have studied the history of settlement and colonisation during the last two or three hundred years in other parts of the world it will seem perfectly justified and reasonable. On the other hand the States will never develop extensively and be so progressive as they ought to be while there is neglect of this important matter. Those engaged in the pastoral and agricultural industries upon which the prosperity of the country so much depends, become dispirited by the disastrous effects of recurring droughts, and in time the whole of the Commonwealth acquires an evil reputation, which spreads far and wide, doing much harm to the best interests of rural settlement and retarding colonising enterprise in many ways. And this in point of fact is a condition which may be said to apply to all parts of the Continent where the rainfall is inadequate and irregular.

COMMERCIAL ASPECT.

In conclusion the commercial or business side of the subject may fairly claim some slight attention. Viewed in the light of past Australian experience it cannot be said that the prospects in this direction are remarkably bright. But that is all the more reason why every effort should be put forth to make the Northern Murrumbidgee irrigation scheme successful. We must profit by the failures of our neighbours, and indeed by other failures as well, and learn by experience how to avoid the pitfalls that usually lie before those who set out on new enterprises. The initial stages are mostly difficult to overcome in all pioneering undertakings. And in this particular undertaking there is almost sure to be some delay in getting the right sort of settlers to take up the land to be irrigated. But once the great advantages of the scheme become widely known there will be fewer obstacles in the way and less cause for anxiety as to future success. There is one thing certain that a step in the right direction, has been taken, for the country will always labour under great disadvantages so long as there is no effort made to reclaim the waste lands of the western district and to minimise the effects of drought by the conservation of water. And to those who have had the privilege of reading the enlightened and instructive remarks of the Hon. J. H. Carruthers, Premier of New South Wales, and his Minister

for Public Works in opening the Conference of delegates assembled in Sydney to discuss the subject in 1905, there could be no doubt left in the mind that the Government policy is one calculated to have a far reaching and most beneficial influence on the future prosperity and welfare of the State. And, moreover, if the opportunity is given as now seems likely to carry the scheme to a successful issue the promoters will have done more lasting good for the country than has ever been done by any enterprise before. There is one element in the project which to my mind will contribute largely to possible success. That is in the great advantage afforded by gravitating the water on to the land instead of having to pump it, which latter should never be attempted, unless for very small holdings, such as cannot be otherwise watered. It will never pay to pump water for extensive irrigation works, whether in this country or elsewhere.

A combination of circumstances will necessarily contribute to the commercial success of this Murrumbidgee irrigation scheme and a great deal will depend on the complete organisation and harmonious arrangement of these contributing factors. It must first of all be recognised as the underlying principle of the whole undertaking that the entire water supply will be under the direct control of the Government; that the administration of the scheme will be in the hands of men qualified for the position, and that the enterprise will be conducted on BUSINESS LINES. With the view of encouraging settlement and inspiring confidence the object should be to AVOID RISKS, as far as possible, and proceed on moderate lines, rather than be too hasty and bold in the initial and earlier stages of the movement. It will be found to be more satisfactory and profitable to succeed in a comparatively small undertaking than to attempt something gigantic with the risk of failure. Experience is a capital aid to success and we will be better able to cater for our local requirements some ten or twenty years hence than at the present time. Settlers may then have learnt, for instance, the great advantage of co-operation in cultivating and irrigating the land for agricultural purposes. At present it is purely a matter of experiment, in the case of all concerned, although this is not always admitted.

The increased land values, as estimated by the Government, are in my opinion very moderate and ought to be more than fully realised, when the movement is fairly established.

But, in the best interests of the State, the promoters should be prepared to administer the scheme in the earlier stages on lines calculated to encourage and promote settlement and increase population rather than with the primary idea of making it "pay."

As indirectly it would "pay" the country to attain these objects

through the development of the scheme, even should there be no material gain for some time to come at least. And this is the spirit in which the movement should be regarded by the public and all who are interested in the prosperity and welfare of the country at large.

After the reading of the paper Mr. George Phillips, C.E., said :—I desire to compliment Dr. Thomson on his very admirable paper, which is all the more serviceable because it has not been confined to the particular project at Barren Jack—a name, which, I trust, under the magic influence of water will soon prove inapplicable to the locality.

Dr. Thomson has shown not only what is proposed to be done in New South Wales, but also what has been done in Egypt, in India, in America, in Italy, and elsewhere, and although irrigation projects of such magnitude as those referred to by Dr. Thomson are perhaps not possible in this State, or in Australia generally, still there is no reason—or rather there is every reason—that what is possible should be attempted without unnecessary delay.

And first permit me to say that I entirely agree with Dr. Thomson that no time should be lost in investigating those sources of water supply that appear most promising.

Much useful work of a preliminary character might be done, and at comparatively small cost, if the services of land and railway surveyors were better availed of, and these officers, who are the eyes of their respective departments, placed upon a higher plane of efficiency.

A land surveyor would be none the less useful as a measurer of the earth's surface regarded as a horizontal plane, which it is not, if he also recorded with approximate accuracy some at least of its departures from the horizontal.

Maps which represent the surface of the earth on the horizontal projection only are of very little service to engineers dealing with such questions as the conservation of water, or the selection of roads and railways.

Every surveyor should be skilled in the use of the aneroid barometer, and it should be part of his duty to ascertain and record on his plans the approximate height of one or more well defined points on the survey of each portion of land.

In furtherance of this object the Railway Department might mark on the side of each railway station and on every mile and gradient post along our railways the height of the rails above sea level. The cost would be trifling, but such permanent and reliable bench marks, or points of reference, would be of incalculable service to surveyors in the work I refer to.

Surveyors should also be encouraged to report generally on all matters affecting the water supply of their districts. The fact that they were expected so to do would set them thinking on the subject, and the more thoughtful men (always to be found in any service) would soon qualify themselves by reading, and otherwise, to express opinions of real value.

Even supposing, as is not improbable, that at first the suggestions made, or the opinions expressed, were somewhat crude, and in some cases perhaps of but little value, now and then, at all events, information of great value would be obtained and placed on record.

A good deal might be done with the assistance of the Railway Department in the way of conserving small and occasionally even large bodies of water at suitable places, more especially where the contributing basins are not too large, which, from my experience, I may say are by no means infrequent in undulating country.

If instead of invariably providing outlets to embankments for the purpose of most effectually draining and discharging the whole of the water at the lowest part of such railway embankments as I have indicated above, the outlets were occasionally placed at one or both sides, close to the point or points where the grade line on embankment meets cutting or touches the natural surface of the ground, all water below the level of such outlets would be impounded without the slightest risk to the stability of the embankments, provided, of course, that the outlets were of sufficient sectional area.

Of course, what I suggest could not be regarded as of general application, but speaking from adequate experience of the subject, I am sure that in hundreds of instances the principle might be applied with absolute safety, with much advantage, and at but little additional cost to the country.

Such embankments as I refer to are often constructed from material obtained from what is termed side cutting—that is, from long, comparatively narrow and shallow trenches, cut on either side of the embankment to be constructed. If the material were obtained at a slightly greater cost from a more confined and deeper excavation on the upper side of the embankment, a good and often permanent water hole would be provided at but little additional cost.

As an illustration of what I advocate I may refer to the South Coast Railway at Beenleigh, the route of which I selected. I found the most advantageous and the least expensive crossing of the creek, which serves as the local water supply at Beenleigh, was over and along the then existing embankment forming the dam, whilst the least expensive bridge site was at the adjacent by-wash.

This section of railway was constructed twenty-two years ago, and I have not heard of any trouble arising in consequence of the location of the railway at this place. The drainage area is about 200 acres, the storm water from which could be discharged by a 9ft. or 10ft. circular culvert.

What was safely and economically done at Beenleigh in connection with an existing dam and by-wash might safely and economically be done in many other places, and in the aggregate very large quantities of water conserved for the use of the settlers along our railways.

The railway engineers would probably object to the proposal on the score of the added cost of their works, but such increased cost as might be incurred should be charged to the benefited lands and the construction account relieved.

A large and very serviceable body of water might have been conserved at the railway crossing of the Burnett River, about ten miles below the town of Gayndah, where a rocky bar extends across the channel. I selected this crossing about three years ago, and reported to the Minister for Lands that a low concrete dam would impound a large body of water and throw it back nearly to the town of Gayndah, in the neighbourhood of which there is much land, on either bank of the river, that might be irrigated to advantage.

This work might have been undertaken in conjunction with the railway bridge and the added cost, which probably would not have exceeded £10,000, charged to the Lands Department, to be eventually recouped by the increased value of the adjacent Crown land. The work could have been much more advantageously carried out in conjunction with the railway bridge under the supervision of the experienced and skilled engineers of the Railway Department, than it could now be done. In fact the bridge should have been built on top of the concrete dam.

Whilst I agree with Dr. Thomson that in extensive irrigation projects, such as that at Barren Jack, it is very desirable that the stored water should be ap-

plied to the irrigable areas by gravity, still it is a fact that the only large irrigation works in Queensland are dependent upon pumped supplies. I refer to the works on Pioneer and Kalamia Sugar Plantations on the Burdekin delta, where about 12,000 tons of sugar have been annually produced for many years from irrigated cane. To the works at Messrs. Gibson Brothers' and Howes' Sugar Plantation at Bingera, on the Burnett River, where the water is lifted in some cases as high as 250ft., and to Fairymead, Messrs. Young Brothers' Sugar Plantation, on the Burnett River, near Bundaberg, where large quantities of ground water are pumped from shallow wells.

The three irrigation works I have referred to have proved eminently successful, and have been carried out by Queensland engineers without any assistance from abroad, and, with Dr. Thomson, I deprecate the quite unnecessary policy, so often adopted in this State, of referring engineering projects of some little intricacy to foreign engineers. It has not been considered necessary (at all events for many years past) to import gentlemen learned in the law or in medicine, or even in the more delicate and difficult science of government. For these and many other things the man of local training and experience is considered good enough, but how often has this State been bled to little and often to no purpose for the benefit chiefly of foreign engineers who have contributed nothing to the material benefit and upbuilding of this State.

No doubt much ground water will yet be discovered in the vicinity of large rivers, and in this repect probably the State is much better off than is generally supposed.

I recently reported to the Minister for Lands upon the probable existence of extensive ground water supplies in the valley of the Boyne River, near Gladstone.

Of perennial streams from which large quantities of water might be drawn without the assistance of weirs there are not many in this State.

Perhaps the most remarkable, because draining a naturally dry district, is the Gregory River (discovered by the late William Landsborough in 1861, and named by him in honour of the late Sir A. C. Gregory), which flows partly into the Albert and partly into the Nicholson Rivers, which discharge into the south-western corner of the Gulf of Carpentaria.

The Gregory is a perennial stream, carrying a very considerable volume of apparently excellent water, even in the driest seasons. In March, 1896—the season being dry—I estimated the flow of the eastern branch of the Gregory, in the vicinity of Gregory Downs cattle station, at 140 million gallons per day. The land on the banks of the river is exceedingly fertile, and well adapted for irrigation purposes, but it would be well to have the water of a dry season analysed before undertaking works on an extensive scale.

On the east coast of Queensland there are several large rivers, or rather rivers draining large areas, such as the Brisbane, 5000 square miles ; the Mary, 2,500 square miles ; the Burnett, 12,000 square miles ; the Fitzroy, 55,000 square miles ; the Burdekin, 50,000 square miles ; but the largest rivers do not always carry the most water in dry seasons.

The best watered rivers I have seen, reckoning from the south towards the north, are the Boyne at Gladstone, the Pioneer at Mackay, the Herbert at Ingham, the Johnstone, Beatrice, and Russell Rivers at Geraldton, and the Mulgrave at Cairns.

THE WESTERN PROBLEM.

As a rule the rivers of Western Queensland have such small and inconsiderable channels as to be of very little service as reservoirs, whilst the beds and

banks are chiefly composed of soft material very easily eroded. Nevertheless the heads of such of the Western rivers as take their rise in mountainous country such as the Maranoa, Warrego, Nogoa, and Comet should be examined with a view to ascertain if suitable sites for reservoirs of large capacity exist. The western side of the Great Dividing Range should be similarly examined, more especially at the heads of the large tributaries of the Condamine and Balonne Rivers.

Fortunately, in those parts of Queensland which naturally are the most arid, where surface water was generally conspicuous by its absence, we now know that large supplies of artesian water exist. But even this truly grand supply is not inexhaustible, for it has been computed by an eminent authority, Dr. R. L. Jack, that as far back as 1895 we had tapped somewhere about the 180th part of the probable artesian supply. Nor is artesian water cheap water ; so that, bearing in mind the limited quantity that can be drawn from any one bore and the cost of boring, it is not probable that even where water suitable for plant life can be obtained (a by no means universal or even general experience) that artesian water will be extensively availed of for irrigation purposes.

Although such large irrigation projects as that of Barren Jack are probably not practicable in Queensland for the lack of suitable sites for reservoirs of large capacity, nevertheless I have no doubt that the conservation and use of water for irrigation purposes will grow from year to year throughout the State, and that when the necessity of providing for a dense population arises the necessary water will be found or conserved, and utilised.

Mr. E. C. Barton raised the question of artificially raising those draughts of air which produce rain. He looked forward to the time when the Western country would be equipped with huge fans to force the air upward, and so cause a disturbance of the cold air above and the warm air beneath.

His Excellency the Governor said there had been a great deal of loose talk about water conservation in Australia. The paper would be of advantage in showing the difference between the irrigation schemes in America, India, and Egypt, and the conditions in Australia. It was obvious that the supply in the Nile or the Ganges was vastly different to that in the Condamine, for instance, which he had the opportunity of crossing twenty-one times in the one day recently. The magnitude of even the Barren Jack scheme could scarcely be compared with the Nile dam, for instance. Moreover, the fertilising agencies in suspension in the Nile and Ganges waters could scarcely be compared with that held in the waters of Queensland rivers. The close population on the lands in India could not be compared with the thinly-populated lands in Australia. He would also like some information regarding the starvation of sheep mentioned. He understood the sheep died from starvation, and not from thirst. The value of the paper lay in the demand for investigation, in which there was a wide field. His Excellency concluded by proposing a vote of thanks to Dr. Thomson.

The Hon. A. Morgan, in seconding the motion, said the paper dealt with the subject in that thorough and comprehensive manner so characteristic of all the author's work. Little attention had been paid in Australia to the question of irrigation primarily, because all spare money had been spent on railways. Another reason was that the initial experiments in irrigation in Australia had not been on satisfactory lines.

The motion was carried by acclamation. Dr Thomson responded.

THE BRITISH SYSTEM of WEIGHTS and MEASURES; A SUGGESTED SIMPLIFICATION, and ADAPTATION TO THE METRIC SYSTEM.*

BY G. PHILLIPS, C.E.

INTRODUCTORY REMARKS: largely compiled from various sources.

In view of the exceedingly varied and often very minute differences that exist in the weights and measures of different countries, and even in different parts of the same country, it is not necessary to dwell at any length upon the advantages that would accrue from the adoption of a uniform and scientifically arranged system of weights and weasures for the civilized world.

It is granted on all sides that uniformity would be desirable, were we now called upon to settle the matter for the first time. But such is not the case. Not only would we have to learn the new system, but we would have to unlearn, and, as far as possible, forget the old system—much the more difficult thing of the two. We have to deal with a net-work of prejudice, and a dead weight of habit amongst the artisans, mechanics, and the agricultural classes, which can scarcely be appreciated by men of science and leisure—who are the chief advocates for change.

Previous to 1878, when the use of provincial weights and measures in England was abolished in favour of the Imperial standards, wheat was sold in many different ways. For instance, in Bedfordshire by the "load" of 5 imperial bushels of 8 gallons each. In Cheshire the bushel measured $9\frac{23}{28}$ gallons. The Cornish bushel held 16 gallons at Launceston, and 24 gallons at Helston. In Middlesex the bushel contained $8\frac{1}{2}$ gallons; in Monmouth 8 gallons. Suffolk had its "Coomb" or half a quarter, to which I shall make further reference. Northumberland, like Scotland, had its "Boll," the capacity of which varied with the grain to be measured. Flintshire had its "Hobbet," equal to two measures or four strikes, or 21 gallons or 168 pounds. Glamorganshire had its "Stack" of three imperial bushels for wheat, and six imperial bushels for oats.

The Suffolk farmer who thought in "Coombs," would be advised by his agent in Northumberland that wheat was so much per "Boll," and from Flintshire that the price of wheat ranged so much per "Hobbet." At Mark Lane, however, he could only sell by the "Quarter," that mysterious measure of capacity, the original source of which is lost in the mists of antiquity.

*Read before the Royal Geographical Society of Australasia, Queensland, April 30th, 1907.

When we speak of tons, hundredweights, and quarters, we know that in this connection the term "quarter" means the one-fourth part of a hundredweight.

When we refer to quarts and gallons we understand that the term "quart" is merely an abbreviation for one-fourth part of a gallon, but how or where the Quarter measure of capacity originated it is now impossible to say. It if ever was the one-fourth part of a definite measure of capacity, as its name implies, then that measure must have contained, approximately at all events, 256 gallons or 32 bushels, or 70,982 cubic inches.

There are three English measures of capacity larger than the quarter that are now practically obsolete. These are the "Chaldron," the "Wey," and the "Last," which contained respectively 36, 40, and 80 bushels, but of none of these could the "Quarter" be regarded as the one-fourth part, although it is easily commensurable with each as follows:—

4½ quarters	equal	1 Chaldron.
5 quarters	,,	1 Wey.
10 quarters	,,	1 Last.

The largest British measure of weight is the "Ton" of 2,240 pounds avoirdupois, equal to 3½ quarters. Although it might be thought that the measures I have named have been fixed in an arbitrary manner, still there is evidence of some care and forethought in their arrangement, as will appear from the following statement:—

1 ton + 1 quarter, equal 1 Chaldron of 36 bushels.

1 ton + 1 quarter + 1 coomb, equal 1 Wey of 40 bushels.

1 ton + 1 chaldron + 2 quarters, equal 1 Last of 80 bushels.

It is evident that the measure of which the "Quarter" was presumably the one-fourth part is not now to be found in the British Isles, so that if it ever existed it must be sought for elsewhere.

I propose to show on the authority of the late Professor C. Piazzi Smyth, formerly Astronomer Royal for Scotland, that such a measure has existed for more than 4000 years, and that extraordinary precautions were taken for its preservation throughout the dark ages that have intervened.

The measure I refer to is to be found — now unfortunately in a mutilated condition—in the largest and most unique structure ever erected by the hand of man, namely the Great Pyramid of Jeezeh, in Egypt. This pyramid as originally constructed was 485 feet in height above the foundation course, by 764 feet in length at the base of each side. It covers an area of 13⅓ acres, and, with the exception of two or three small chambers, and some narrow galleries leading thereto, is solidly constructed of stone throughout.

As evidence of the care with which this remarkable structure was designed and erected, I may mention that the four sides face the cardinal points at North, South, East, and West, with such precision, that the orientation of the building is only in error to the extent of $4\frac{1}{2}$ minutes of arc, equivalent to one British foot of 12 inches in the length of the side, that is one foot in 764 feet—a most remarkable approximation to truth, seeing that the architect had no instruments of precision such as we have in these days.

Professor Smyth, in his well-known work on the Great Pyramid, published in 1874, gives good reasons for assuming that the Pyramid was built about the year 2170 B.C., or 4,077 years ago, and about 150 years before the birth of Abraham.

At about the centre of gravity of the immense mass there is a small chamber $34\frac{1}{3}$ feet long, by 17 feet wide, and 19 feet in height, called the "King's Chamber." This chamber was approached by a gallery, which first descended and then ascended, the entrance to which was hidden with the greatest care by the architect, and so successfully, indeed, that when the Caliph Al Mamoun desired to break into the Great Pyramid in search of supposed hidden treasure, in the year A.D. 820, he could not find the true entrance to the gallery, so that at a great expenditure of labour, he forced a passage by random tunneling, until quite accidentally, owing to the fall of a stone, the workmen obtained a clue to the position of the gallery and eventually broke into it.

In the interior of the King's Chamber the Arab workmen found a lidless granite coffer, the external dimensions of which are approximately 90 inches x $38\frac{2}{3}$ inches x $41\frac{1}{4}$ inches, the mean thickness of the sides being 6 inches and of the bottom 7 inches. A great controversy has raged round this plain stone coffer. Generally, it is assumed to have been meant for a sarcophagus or coffin, by some assigned to King Choofoo of the fourth dynasty, the Cheops of Herodитus, but the absence of any inscription, either on the coffer or on the walls of the King's Chamber, coupled with the fact that no body or mummy was found in the coffer, militates against that theory.

Professor Smyth has shown with infinite care that the architect of the Great Pyramid (of which the other pyramids appear to be, more or less, unintelligent imitations), constructed his stone book (which was absolutely free from inscriptions or hieroglyphics of any description), for the purpose of revealing to future ages the knowledge of the scientists of that day in relation to heavenly and terrestrial phenomena, a knowledge which he foresaw would be overwhelmed and lost during the flood of barbarism which subsequently swept across

Egypt and from which it is only now commencing to emerge owing to the British occupation.

From very careful measurements made by Professor Smyth, it appears that the internal capacity of the stone coffer was 71,295 cubic inches, or 257.13 gallons, the fourth part of which would only exceed the British Quarter of the present day by 0.28 of a gallon, or 2.8 pounds avoirdupois, in a measure the capacity of which is equal to 640 pounds of water.

Whether Professor Smyth was right or wrong in his conjecture, the co-incidence is certainly a very remarkable one, and is worthy of respectful attention. I have previously shown that the Suffolk "coomb" was equal to half a quarter, or the one eight part of the capacity of the Great Pyramid coffer. According to Webster's International Dictionary the word "coomb" is probably derived from the Latin word "cumba," a tomb of stone. How often we find the proportion of one eighth in the British dry measure, thus :—8 pints equal one gallon ; eight quarts equal one peck ; eight gallons equal one bushel, and eight bushels equal one quarter, whilst eight quarters equal two pyramid coffers, or 5120 pounds of water, equal to the sum of one chaldron and one ton, whilst the difference of the chaldron and the ton is exactly equal to the quarter. Surely there is something more than mere co-incidence in the apparently clumsily constructed British system of dry measure, the basic proportion of which is represented by the number 8. It will be found on experiment that any number divisible by 8 is much more amenable to binary division than multiples of 10. For example 112, 56, 28, 14, 7, as compared with 100, 50, 25. Note also the division of the British inch into 8ths, 16ths, 32nds, &c.

Scotland had a system of weights and measures distinctively its own, as might be expected from a country which never was conquered.

The unit of liquid measure was the Scotch pint, a truly liberal and hospitable measure, which contained nearly three times as much as the English pint, but I presume to compensate for this liberality in the measurement of his liquor, the Scotsman was content to call 12 pennies English one pound Scotch. His mile, however, is longer than the English.

The original basis of English measures was the grain of wheat. 32 grains, well dried, and gathered from the middle of the ear, were regarded as the equivalent of one silver penny, hence the term pennyweight. Is it a mere co-incidence, I would ask, that the number of grains of wheat, 32, made exactly one grain of wheat for every bushel in the capacity of the Great Pyramid coffer ? Note also that 32 is

divisible by 8, but not by 10. Subsequently it was considered more convenient to divide the pennyweight into 24 rather than into 32 equal parts. These were still called grains, so that the 24th part of a pennyweight may be regarded as equal to 1⅓ grain of wheat. Observe that 24 is divisible by 8 but not by 10.

Troy Weight was introduced into England by William the Conqueror, the name being derived from Troyes, a town of France, where a great fair was held every year.

The English were dissatisfied with this weight, because the pound Troy did not weigh so much as the pound at that time in use in England, consequently a mean weight was established, making the pound equal to 16 oz. Hence arose the term Avoirdupois, descriptive of the new, or mean pound.

The original measure of length in England, was that of a grain of barley corn, three grains, well dried, placed end to end, were regarded as the equivalent of the inch.

The length of the arm of King Henry I. of England was made the length of the Ulna or Ell, which answers to the modern yard, so that, presumably, the king's arm was 3 feet or 36 inches in length. My arm is 30 inches in length, so that on the basis of length of arm in proportion to height, the king should have been about 6 feet 9 inches in height.

The standard British yard was defined by the Act of 1825, to correspond with a certain length marked by gold studs let into a brass rod deposited in the House of Commons. It was considered essential that the length of the standard yard should always remain the same, and that if ever the standard should be lost or destroyed, it could be restored by comparison with a datum of length which should remain constant in perpetuity. This datum was afforded by the length of a pendulum vibrating seconds of time at Greenwich or London at the level of the sea, in a vacuum.

An occasion was early afforded for giving effect to the principle of restoration by reference to natural standards, by the fire of 1834, by which the House of Commons, and the standards it contained, were destroyed.

The question of the restoration of the standards was very carefully considered, and the commissioners unanimously agreed that it was better to trust to the preservation of the standards by material representatives, great care being taken for the conservation of these representatives or copies.

The measure of the earth, or the measure of the seconds pendulum, is a work of great difficulty and labour, and, what is worse, its immediate results must be subjected to certain theoretical corrections, which,

from the imperfections of theory, introduce either error or doubt. So rapidly, in the advance of science, did these vitiate the conclusions, that it was found, in 1836, that the natural basis sanctioned by the Legislature in 1825 would produce results sensibly erroneous. The plan adopted, therefore, for the construction of the new standards was the following :—Length scales, which had been compared with the lost yard, and pound weights, which had been compared with the lost pound, were found sufficient for restoring the values of the old standards.

In ancient and prehistoric times when great accuracy was of much less importance than in these days when science is turning the world into a huge workshop, the various parts of the human body served as standards of length.

Thus the thumb-breadth was regarded as equivalent to the inch, a measure which is found in many parts of Europe. The hand was regarded as equal to 4 inches, and the foot to 12 inches, whilst the distance between the elbow and the point of the middle finger was called a cubit, variously estimated at from 18 to 22 inches. The pace or natural stride of a man of average height is regarded as 30 inches.

Even in these enlightened days I have observed ladies measuring calico by finger lengths, a rough and ready, but probably sufficiently accurate method for the purpose.

Standards of lengths based on the human body are exceedingly interesting, and appear to show that the average man of the present day is somewhat smaller than in ancient times, for surely there are not many men alive whose arms would equal in length that of King Henry I., whilst comparatively few if any men now-a-days have feet of full 12 inches in length.

I am a man of average height, and, as my foot is 10 inches long, I infer that a man possessed of a 12 inch foot should be about 6 feet 9 inches high, which I have previously shown was the probable height of King Henry the First of England.

The British system of weights and measures is certainly a very complicated one and is generally regarded as both clumsy and unscientific as compared with the French or Metric system. The latter is, comparatively speaking, modern, and scientifically constructed. It is based upon a measure of length, the metre, or the ten millionth part of a quadrant of the meridian passing through Paris. That is to say the metre is supposed to correspond, and was primarily intended to correspond with that measure, but subsequent triangulations revealed an error in the earlier surveys, so that the length assigned to the metre is shorter than its actual geodetic value to the extent

of about the one-sixth part of a millimetre, the proportion being that of 6,400 geodetic metres to 6,401 French statute metres.

The units of the metric system are all interrelated, as follows :—

Unit of long measure—the metre or 39.38203 British standard inches at equal temperature in the open air.

Unit of square measure—the are or 100 square metres.

Unit of solid measure—the sterè or 1 cubic metre.

Unit of weight—the gramme or the weight of one cubic centimetre of distilled water at a temperature of 39.2 deg. Fah., equals 15.4323 British grains.

Unit of capacity, dry or liquid—the litre, or the cube of the 10th part of a metre, equals 1.7637 British pint.

Unit of money—the franc, equals 5 grammes.

From the comparision I have made it will be seen that the British and French systems are widely different, and it might appear a hopeless task to assimilate the systems and yet to retain the basis of each.

I propose to show, however, that by a few slight alterations, only one of which is other than nominal, the British system might be brought so nearly into line as regards linear, superficial and solid measures, that for all industrial and commercial purposes, the two systems might be regarded as interchangeable. The British measures of length have varied from time to time, but in 1824 they were fixed by statute, whereby the length of the British inch was defined in relation to the length of the pendulum marking seconds of mean time at London (39.13929 inches), which, singularly enough differs from the length of the metre by only .243 inch, the comparison being as follows :—

Metre	39.38203	British inches.
Length of seconds pendulum at London	39.13929	,, ,,
difference	.24274	,, ,,

The alterations I would venture to suggest in the British system are as follow.

The link, or the hundredth part of the surveyor's chain of 66 feet, contains 7.92 British standard inches.

In all English speaking countries land surveys are based on the decimal system, and in this respect represents that portion of the British system of measures that deserves our respect and should be jealously guarded from innovation and change.

Unfortunately, however, the link of 7.92 inches and the foot of 12 inches are very badly related, and it appears to be impossible to bring them into harmony without altering one or both of those measures of length.

It has already been shown that an alteration in the length of the link is most undesirable. In fact the best of reasons exist for the retention of the link as the basis of long measure.

The unit of measure that might most conveniently and with the least inconvenience be altered is the inch, the ancient equivalent of the thumb breadth.

Taking the link, therefore, as an unalterable unit in British measures, it is suggested that it be divided into eight equal parts, to be called for purposes of differentiation, "short inches."

A short inch would be $\frac{99}{100}$ or .99 of the present British standard inch. The alteration would be so slight as to have no appreciable effect in the measurement of small things, such as workshop gauges, dies, &c.

It appears impossible to satisfactorily bring the 12 inch foot into line with the suggested alteration of the inch. It might be advisable, therefore, to entirely abandon the 12 inch foot.

As the inch is the basis of the foot and yard measures, there does not appear to be any insuperable reason why a 10 inch foot should not be adopted. Two of these short feet, or 20 inches, might be termed a cubit, and thus avoid the confusion that might arise between the 12 inch and 10 inch foot. The cubit was anciently regarded as the length from the elbow to the tip of the middle finger, and has been variously estimated at from 18 to 22 inches.

The adoption of the short inch (one eighth of a link), of the 10 inch foot and the 20 inch cubit (two and a-half links) would have no effect on the survey of land, which would still be measured with the 100 link chain, but the chain would contain 800 short inches, instead of 792 British standard inches, also 40 cubits and 80 feet, instead of 66 feet as at present. It is further suggested that the yard measure should be increased from 36 to $39\frac{6}{10}$ British standard inches, equivalent to 40 short inches, to be called for purposes of differentiation "the long yard." The fathom would equal two long yards.

The chain and the mile, like the link, would remain unaltered, and would contain 20 and 1600 long yards, instead of 22 and 1760 short yards, as at present.

As the British statute mile contains 1608.86 metres, it will be seen how closely the long yard would compare with the French metre.

A kilometre, or 1000 metres would equal 994.5 long yards instead of 1094 British standard yards as at present.

The long yard of 40 short inches, or $39\frac{6}{10}$ British standard inches, would exceed the metre by less than one quarter of an inch (the actual difference at equal temperatures in the open air being

.218 standard inch), so that for all commercial and industrial purposes the long yard and the metre might be regarded as convertible terms.

If the long yard were divided into one hundred equal parts (centiyards) then the centiyard might be regarded as the equivalent of the centimetre, from which it would differ by .00272 of a British standard inch, a quite inappreciable difference in the measurement of small things.

As the metric system is based absolutely and entirely upon the metre it will be seen how easily similar tables of measure, weight, and capacity might be constructed for British use on the basis of the long yard.

The following table of long measure is based upon the short inch :—

Inches.	Links 8″	Feet 10″	Cubits 20″	Yards 40″	Chains	Mile.
8	1					
10	$1\frac{1}{4}$	1				
20	$2\frac{1}{2}$	2	1			
40	5	4	2	1		
800	100	80	40	20	1	
64,000	8,000	6,400	3,200	1,600	80	1

The following is a table of solid measure, based on the short inch :—

Inches.	Links 8″	Feet 10″	Cubits 20″	Yards 40″	Metres.
512	1				
1,000	1.953	1			
8,000	15.625	8	1		
64,000	125	64	8	1	
62,950	122.95	62.95	7.87	.9836	1

The short inch lends itself to the computation of weight much more advantageously than the present British standard inch, for instance, one British standard inch of rain falling upon one acre equals 101 tons of water, whereas a short inch of rain on one acre equals 100 tons.

By the presents measures one cubic inch of distilled water at 62 deg. Fah., equals 252.45 grains or .036065 lb. avoirdupois ; the cubic foot contains 62.321 lbs. of water, and the cubic yard 1682.67 lbs. of water, or 168.267 gallons.

On the basis of the short inch the comparison would be as follows :

1 short inch cubed equals 245 grains weight of water at 62 deg. Fah.

1 link cubed equals 17.92 pounds avoirdupois.

1 10 inch foot cubed equals 35 pounds avoirdupois or $3\frac{1}{2}$ gallons.

1 20 inch cubit cubed equals 280 lbs. or 28 gallons.

1 40 inch yard cubed equals 2,240lbs. or 1 ton equals 224 gallons.

The hand or half link of 4 short inches cubed, would contain2. 24 lbs. avoirdupois of distilled water at a temperature of 62 deg. Fah., whereas under the same conditions the litre contains 2.2046 lbs., showing that the elements of the long yard, even when cubed, are closely comparable with the similar elements of the metre.

The cubic centimetre or gramme equals 15.4323 grains.

The cubic centiyard equals 15.6800 grains.

The difference being less than one quarter of a grain.

From the comparisons I have made it will be seen that the adoption of the short inch combined with the 10 inch foot, 20 inch cubit, and 40 inch yard, would admit of the British system of weights and measures being greatly simplified, whilst they would so closely approximate to the metric system that for practical and commercial purposes the two systems might be regarded as interchangeable.

It might be asked, of course, if it be desirable to approximate the English to the French system, why not go the whole way and adopt a yard exactly equivalent to the French metre ?

Such a course, however, would involve the alteration not only of the inch and the yard, but of every other measure of length in use by the British, whilst accurate comparison between the new measures and the old would be extremely complicated and difficult.

For example, the metric inch, taking 40 metric inches as equal to one metre, would be .98455 of a British standard inch, instead of $\frac{99}{100}$, as I suggest.

There are 1608.86 metres in a British statute mile instead of 1,600 long yards as I suggest.

There are 20.1107 metres in a chain, instead of 20 long yards as I suggest.

There would be 8.044 metric inches in a link instead of 8 short inches as I suggest.

A metre contains 4.972 links, whereas the long yard of 40 short inches would contain 5 links.

The cubic metre has a capacity at 62 deg. Fah. equal to 2204.6 lbs. of distilled water, whereas the long yard cubed would have a capacity at a temperature very slightly higher than 62 deg. Fah. of 2,240 lbs. (1 ton) or 224 gallons of water.

If the metric system be adopted, we must abandon the British weights and measures ; but by the simple process of reducing the British inch by the one hundredth part, so that eight short inches would equal one link, and by adopting a yard of 40 short inches, we might, as I have shown, simplify our measures very much, and gain all the practical advantages that are to be gained from the metric system, at a minimum of inconvenience and practically at no expense, whilst

retaining all our time honoured terms of the inch, link, foot, yard, chain, mile, as measures of length, our pint, quart, gallon, peck, bushel and quarter as measures of capacity, and our grains, penny weights, ounces, pounds, hundredweights, and tons as measures of weight, whilst all these measures would be easily comparable, and many of them if desired would be readily interchangeable, with metric measures.

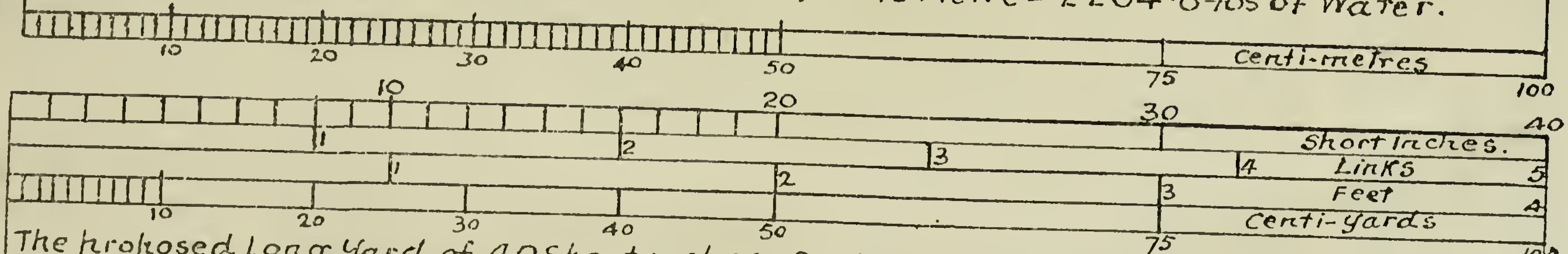
The metric system was adopted by France in 1793, and has been compulsory by statute since 1840, yet to this day many of the old French measures are still in use.

Phillips on British System of Weights and Measures

The Metre Compared with the proposed Long yard of 40 Short inches.

Scale 1/6

Metre = 39·38203 British Inches or the 10,000,000 part of Quadrant of Meridian of Paris.
1608·86 Metres = 1 British Statute Mile. 1 Cubic Metre = 2204·6 lbs of Water.



The proposed Long Yard of 40 Short inches = 39·6 British inches. 20 Long Yards = 1 Chain. 1600 Long Yards = 1 British Statute Mile. One long yard cubed = 3½ Quarters, or 28 bushels, or 224 gallons, or 2240 lbs, or 1 ton of water. The Short Inch = 99)100 British Inch. 8 Short inches = 1 Link; 5 links = 1 Long Yard. 20 Short inches = 1 cubit. 10 short inches = 1 foot.

Length of Pendulum Vibrating Seconds of Mean Time at London = 39·13929 British Inches.

Pyramid Cubit of 25·025 British Inches = $\frac{\text{Earths Polar Axis}}{20,000,000}$

G. P.
14 : 8 : 07

INITIATION CEREMONIES OF THE MURAWARRI AND OTHER ABORIGINAL TRIBES OF QUEENSLAND.*

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In 1902 I contributed to this Society a paper dealing with the elements of the grammar of the Murawarri language.[1] In 1905 I reported the details of the social structure of the Murawarri, Baddyeri, Inchalanchee and other tribes in southern and northwestern Queensland.[2] On the present occasion it is intended to supply a short account of the *Multyerra* ceremony of the Murawarri and Baddyeri communities in southern Queensland.

The same initiation ceremonies, with immaterial modifications, are in force among the Burranbinya and Kurnu tribes in New South Wales, who adjoin the Murawarri on the southwest.

It is hoped that the following details will be found sufficiently full to admit of comparison with similar ceremonies practised in other parts of Queensland.

The particulars now submitted were obtained by me personally from intelligent old natives belonging to each of the tribes mentioned.

In 1900 I published a detailed description of the "*Toara* ceremony of Initiation,"[3] which was practised on the Queensland coast from Port Curtis southerly to the New South Wales boundary, extending inland to include the valleys of the Dawson and Condamine rivers.

That was the first account of the *Toara* which had ever appeared.

I therefore claim the credit of being the first to preserve a record of these two important and interesting ceremonies—the *Multyerra* and the *Toara*.

When it is found that there are a sufficient number of boys old enough for initiation, the headman of the tribe, whose turn it is to call the community together, sends out messengers to all the neighbouring tribes.

The headman does not take this step on his own responsibility, but after due consultation with the elders of his people.

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*Read before the Royal Geographical Society of Australasia, Queensland June 6, 1907.

1, "Murawarri and Other Australian Languages," *Queensland Geographical Journal*, xviii., 52-68.

2. "Ethnological Notes on the Aboriginal Tribes of Queensland." *Ibid.*, xx , 49-75.

3. *American Anthropologist*, ii., N,S., pp. 139-147.

Two messengers, *buruki*, went together and were accompanied by a young man who had been admitted at the preceding *multyerra*.

These men carried with them, as an emblem of their authority, a *multyi*, composed of a portion of a wallaby skin cut into narrow strips or strands, which were bound together at one end whilst the other extremity was free, so that the strands could hang down separately.

Attached to the bound end of the multyi were a few feathers fastened to it with string.

The messengers were also supplied with a *wilpabulka*, or man's belt, and a bullroarer, *yantamakaddya*.

On the arrival of these messengers at the camp of the people they were directed to summon, the procedure was substantially the same as that described by me in my reports of the initiation ceremonies of the Kamilaroi, Wirradyuri, Darkinyung, and other tribes, and may be summarized as follows.

The bearers of the message, on approaching the confines of the camp of the strange tribe, sat down in view of the single men's quarters, and made friendly signs.[1]

Some of the old men then went over to them, and, after the usual smoke ordeal, conducted them to the private meeting place of the initiated men, *ngurnungulla*, where they were introduced to all the chiefs and warriors.

After a while they produced the *multyi*, *wilpabulka*, *yantamkaddya*, and any other articles which might have been entrusted to them, and delivered the verbal message as to the time and place of holding the *multyerra* ceremony.

In the course of a day or two, the invitation is sent forward to the next tribe farther on.

This is done either by the same messengers, or by the headman of the tribe they have visited. If the latter course is followed, the headman selects from among his own people suitable men to act as messengers, to whom he hands the *multyi*, bullroarer, and other emblems which he has received. These men then start away to the next tribe, and this procedure is repeated until the whole community has been invited.

It is important to point out that each headman, in issuing his invitations selects messengers belonging to his own phratry, and dispatches them to other men of that phratry in the invited tribes.

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1. This rule of entering an aboriginal camp not only applies to strangers, but to members of their own tribe. When a man has been away hunting or visiting, or on any other business for a few days, or for a longer time, he does not march into the camp on his return in the way a white man does, but sits down, a little distance off, till some of his friends go to him. He is invariably passed through a dense smoke, made by laying green bushes on a hot fire,

The men are also frequently of the same totem as their chief.

During the time the messengers are away issuing the invitations, the men of the local tribe, who act the part of hosts, are busy preparing the common meeting ground. The locality selected for this purpose is a suitable area of moderately level ground, in the proximity of water, and where firewood is obtainable. It is also chosen in a portion of the tribal hunting grounds where game is sufficiently abundant to afford a supply of food for the people who are in attendance while the ceremonies last. The local mob are the first to erect their quarters, and the other tribes who have been invited encamp around this as a datum point, each in the direction of the country from which they have come.

In the vicinity of this main encampment a circular space, called *multyeragara* about twenty-five or thirty yards in diameter, was cleared of all timber and grass and made level. A narrow pathway, *yutthuru*, formed by cleaning the ground, and throwing the loose earth on either side, led from the circle or *multyeragara* to another similarly cleared space, named *bulkinya*, about fifteen or twenty chains distant, or sufficiently far to be out of sight of the main camp. Within the *bulkinya* were a few small mounds, heaps called *kunya*, formed by laying some pieces of wood on the surface of the ground and covering them over with loose earth. In the centre of each heap was inserted a stick, resembling a human phallus of prodigious proportions.

The messengers remain with the tribe to whom they have been sent until the time arrives to start for the appointed meeting place. All the men, women and children are then mustered, and the journey commenced towards the *multyeragara*. On nearing the general encampment a halt was made, and the women, children, and aged people remained there with the baggage for the present. The men then formed into single file, and marched forward in a sinuous line towards the *multyeragara*, where the local people, and such other tribes as had previously arrived, were already assembled. When the new arrivals reached the *multyeragara*, they marched round and round until the last man was within the cleared space. The novices brought by these people for the purpose of being initiated, were in the middle of this compact of men. Upon coming to a stand, they all turned their faces in the direction of the country they had come from, and the headmen shouted the names of their principal camping places, water-holes, hills, creeks, totemic animals, etc. The names of shady trees, blossoming and fruit bearing trees and shrubs, were also mentioned. While the men were making these proclamations, they pointed their boomerangs towards their own territory and stamped their feet on the ground.

At the conclusion of this reception, the novices brought by this contingent were taken by their guardians to a portion of the camp set apart for the accommodation of the novices belonging to all the tribes present. This place is called *wilyarunga* and the novices, accompanied by their guardians are located on the side nearest their own country. In the meantime the women and children who were left behind with the baggage, have moved on, assisted by some of the young men, and have located themselves on their own side of the general camping ground.

About a week or less elapses between the arrival of the first tribe and that of the last contingent which have been invited from the surrounding districts, so that the early arrivals have a few days to wait at the main camp. During this time corroborees are held almost every fine night, the different contingents present taking their turn to provide the evening's entertainment.

As soon as possible after the arrival of all the tribes who are expected to join in the ceremony, the headmen assemble at the *ngurnungulla*, and after consultation among themselves they determine the day when the novices will be taken away for the purpose of initiation. The *thunthurra*, or band of men who are to take charge of the ceremonies in the bush, are selected. The *thunthurra* comprise men from every tribe present. The locality where the women are to erect a new camp and await the return of the novices, is also fixed. The portion of the tribal territory into which the novices shall be taken while passing through the ordeal of initiations is considered and decided upon.

On the day preceding the breaking up of the assemblage, a large bough yard, called *gulpi*, is erected close to the *multyeragara*. This yard is approximately in the shape of a horse shoe, being open at one end. At night fall all the women and children in the entire camp are mustered up to the *gulpi*, and remain there all night. During the evening the bullroarer is sounded by some men who are camped at the *bulkinya*. Next morning, at the first approach of dawn, the novices are awakened, and are lifted on the shoulders of their guardians, by whom they are carried from the *wilyarunga* to the *gulpi*, where they are placed sitting down on green leaves thickly spread upon the ground. The boys of each tribe are kept in a group by themselves, on the side of the gulpi nearest their birth place. The old men then take some nardoo seed, ground into flour by beating it, while in a wet state, between two stones, in the usual native fashion, and spread it on small trough shaped pieces of bark called bultha, serving the purpose of plates. One of these pieces of bark, with its contents, is handed to each novice, and he is directed to eat the nardoo paste.

When the boys have disposed of this food, a small drink of water is given to each of them, after which they take an additional mouthful of water, with which they rinse their mouths and spit it out. This procedure is said to cleanse the mouth and facilitate the extraction of a tooth later on. Each novice is then painted in the manner customary to his tribe, and is invested with a belt, and other articles of a native man's regalia. All the women are gathered inside the *gulpi*, and covered over with boughs, rugs, and grass. They are told that this is to hide them from the view of the malevolent personage who will come for the boys, but its real object is to prevent them from seeing any part of the next performance.

When these preliminaries have been completed, two men commence sounding the bullroarer or *yantamakaddya*, in close proximity, and a few other men come along the path from the *bulkinya*, and run round on the *multyeragara*, beating the ground with a piece of bark held in one hand. These pieces of bark are about the length of a man's arm and about four inches wide at the broadest part, but tapering smaller at the end held in the hand. All the men standing about the *multyeragara* and the *gulpi* shout and beat their weapons together. During the combined noise of the bullroarers, the shouting, and the beating of the ground, the guardians advance and take their novices by the arm and lead them away. Their heads are bowed upon their breasts, and they are forbidden to look at anything.

All the boys are marched away to a clear patch of ground near the *bulkinya*, and one of the central pair of upper incisors is punched out of each novice in the following manner :—A man lies full length, face downwards, upon the ground. The guardian, assisted by some strange men, catches the boy and throws him down lengthwise, face upwards, upon the back of the man who is on the ground. An old man accustomed to the work then sits astride the chest of the boy, who is held in position by the other men. The operator then catches hold of the boy's face, and opening his mouth, pushes the gum back with his thumb nail, and then punches out the tooth with a blow of the small sharp end of his nulla-nulla. He then catches the tooth in his fingers and holds it up to public view.

After all the novices have been operated upon, they and their guardians are taken away into the bush by the *thunthurra*, who are responsible for all the proceedings, and toward evening some suitable camping place is reached, where a crescent shaped bough yard, *nundu*, is made for the boys to sleep in, accompanied by their guardians. On this night, as well as all the time they are kept in the bush with the *thunthurra*, the novices are fed upon young opossums, whistler ducks, teal ducks, nardoo, yams and other vegetable food.

Between the men's quarters and the yard in which the novices are kept, a space is cleared of all loose rubbish, and one or more fires are lit to afford sufficient illumination. After the evening meal has been disposed of, the boys are brought out of their yard and put sitting down facing the fires, while the thunthulla go through various pantomimic performances consisting, for the most part, of imitating animals with which the audience is familiar, or scenes from their daily life. Some of the animals selected are the totems of those present, whilst others are connected with myths and superstitions current among the people.

During the day the men go out hunting, to provide food for all the party, but the novices remain in the camp in charge of a few guardians. Several days may be spent in one camp, or perhaps a fresh camping place is reached every night, especially if game is scarce.[1] In the latter case it would of course be necessary for the novices to accompany the rest of the men. They march along with their eyes cast upon the ground in front, and when stoppages are made in the bush they are placed sitting on leaves strewn upon the ground. On arriving at the place which has been agreed upon as the camping ground for the night, a bough yard is erected for the boys in the usual manner.

Among the numerous pantomimic burlesques enacted for the instruction and amusement of the novitiates are the following. Some of these performances take place at night by the light of the camp fires, whilst others are enacted during the afternoon. The novices are brought up to where one of the *thunthurra* is lying on the ground, apparently in the last agonies of death. Several men are walking about him, imitating crows, and make an occasional peck at a vital part with their mouths, which makes the dying man groan.

Another time the men jump about and pretend to be the birds known as "Native Companions." Sometimes a few men represent kangaroos hopping along, with the *thunthurra* in hot pursuit, throwing spears and clubs after them.

One afternoon the *thunthurra* erect a *gurli*, or hut, the building material being green boughs and bark, a short distance from the camping place, but this is done unknown to the boys. After dusk some of the old men pretend that it is going to rain, and suggest that the boys should be put into the *gurli* for shelter. This is at once

1. Every time that the men and novices moved their camp from one place to another, the women and children also shifted their quarters to a fresh site, but kept some miles away from the men. Messengers were in regular communication between the *thunthurra* camp and that of the women, in order that the men might know exactly where the women were located. A few men remained constantly with the women and children for the purpose of carrying out the instructions in regard to their movements.

done and a big fire lit alongside to keep them warm. Presently the men pretend to quarrel, and a detachment of them surround the *gurli*, and pick up from the fire blazing sticks, coals and ashes, and throw them at the building—some of the hot missiles falling upon the boys. This is called *kurlaburlinya*. After a while the turmoil ceases, and the novices are removed from the *gurli* back to the camp, and all the people retire to rest for the night.

Another day the novices are taken to a place where some old men and middle aged men are lying down, their bodies painted with burnt grass and grease mixed together, and wearing fantastic ornaments in their hair. One of the guardians pretends he can see a star in a bright portion of the sky, and invites the boys to look in that direction. He points his finger and says, "Burli, burli, burli (star, star, star)." After gazing for a little time without finding the star, the novices are permitted to lower their eyes. By this time the painted men have risen to their feet, and now commence swinging bullroarers. The brightness of the sky having momentarily impaired the boys' sight while vainly looking for the star, they cannot see very clearly, and therefore the scene before them is all the more unearthly and awe-inspiring. Some armed warriors now advance in front of the novices and caution them that if ever they divulge any of the ceremonies they have seen in the bush to an uninitiated person, or to a woman, they will be killed. Each novice is cautioned by a man who does not belong to his own tribe. A new name is given to each of the novices in the evening, by which he will always be known among the initiated.

I must now take the reader back to the *multyeragara* and *gulpi* where the women and children were left, covered over with boughs, etc., as described in an earlier page. Shortly after the guardians, novices, and others got out of sight, the covering was taken off the women by some men who remained behind in charge of them. Then they gather up their baggage and remove to another locality, perhaps several miles distant, where they erect a new camp, each tribe selecting their quarters on the side of the camping ground which faces the direction of their native country. The same camp may be occupied all the time the novices are away, or the women may remove to a new camping place every few nights, or perhaps every night, to correspond to the movements of the *thunthurra*. A patch of ground, called *butthuwullu*, is cleared near each of these camping grounds, to which the mothers and sisters of the novices repair every evening for the purpose of singing the customary songs during the time the boys are away. These songs are called *borumbera*.

The period spent by the novices in the bush while going through inaugural ceremonies is about a week or ten days, this matter being regulated by the weather and considerations of obtaining food. Different burlesques and songs take place every day and evening, but the general character of the procedure is the same. When the instruction of the novices is completed, the headmen send messengers to the women, stating that the boys will be brought back to them next evening. About dusk the *thunthurra* guardians and novitiates approach the women's camp. Some men in the rear of the procession sound bullroarers, for the purpose of investing the ceremony with due solemnity. The boys are smoked at a bushy fire and marched to the *butthuwullu*, where they are placed sitting down with their heads bowed. The mother of each novice now approaches, and taps him gently on the shoulders with a piece of bark which she carries in her hand. All the mothers then go away from the *butthuwullu* to their camp. The novices are taken to a place prepared for them, a little distance from the men's quarters.

It should be explained that the bullroarers used in taking the novices away from the *gulpi*, although similar in shape have a different name to those used on the occasion of the return of the boys at the *butthuwullu*. In a few days' time the novices are again taken into the vicinity of the women's camp, and are once more required to stand in a dense smoke, produced by the smouldering of green bushes laid upon a fire for that purpose.

The ceremonies being now at an end, the visiting tribes make preparations for starting on the return journey to their respective countries, each tribe taking their own novices with them. The boys are kept under the control of their seniors for a considerable time yet, and must conform to certain rules laid down by the aged men. It is also necessary that they must attend one or more additional *multyerra* gatherings before they can become thoroughly acquainted with the different parts of the ceremonial and be entitled to share the rights and burdens of tribal membership.

Conclusion.

The time occupied in connection with the initiation ceremonies of the Murawarri tribe and their congeners was kept within the shortest possible limits. When the messengers were sent to gather the neighbouring tribes, the date of the arrival of the several contingents at the main camp were so arranged that they would all turn up within a day or two of each other, if practicable. When all the participating mobs had arrived, the business of the meeting was promptly proceeded with; and when the novices were taken away from their mothers the duration of their sojourn in the bush with the elders was no longer

than was absolutely required. The necessity for all reasonable expediton is obvious when we remember that the whole life of our Australian savages is one continual struggle for existence, and hence the extra demand on the game and vegetable products due to the "invasion" of the visiting tribes is quite a serious and momentous matter.

It may be mentioned here that the above remarks apply to the meetings for initiation purposes in all Australian tribes. In their native state, before they could rely upon getting supplies from the white people, it was not usual for the aborigines to remain in one camp more than a few days, their stay for a longer time depending altogether upon the productiveness of the locality. As soon as the natural food supply was exhausted they were compelled to remove to a fresh camping ground. With a large temporary increase in the number of the people incidental to these ceremonies, the difficulties of obtaining food were correspondingly increased. The various parts of the inaugural rites were consequently disposed of as speedily as practicable, in order to let the visiting tribes disperse and go back to their own hunting grounds.

It will be interesting to philologists to know that, besides the grammars and vocabularies of the Murawarri and Baddyeri languages reported in Volumes xviii and xx of this journal, I have published several grammars and vocabularies of the aboriginal tongues of Queensland, viz :—the Yualeai[1], Pikumbil[2], and Kogai[3]. This makes a total of five aboriginal grammars which have been published by me. It may be mentioned here that what are known as the "inclusive" and "exclusive" forms in the dual and plural of the first personal pronoun, had not been reported in any Queensland language until I published the Murawarri grammar in 1902.

In regard to the important subject of sociology, I published an article in 1898[4], showing the social divisions and intermarrying laws of the native tribes occupying the whole of that portion of Queensland which is situated south of a line drawn from Halifax Bay to Urandangi on the Georgina river close to the South Australian boundary. In the same year I described the sociology of a number of tribes from the Gilbert river northerly to the Mitchell[5]. In 1899 I reported the social organisation of several other tribes on a number of rivers draining into the Gulf of Carpentaria[6]. In the next year, 1900, I described the

1. Journ. Roy. Soc. N.S. Wales, xxxvi., pp. 137-142 and pp. 179-190.
2. Op. cit., pp. 143-145.
3. Zeitschrift für Ethnologie, Band xxxvi., pp. 28-38.
4. Proc. Amer. Philos. Soc., Phila., xxxvii., pp. 327-337, with map.
5. Journ. Roy. Soc. N.S. Wales, xxxii., pp. 250-251.
6. *Ibid*., xxxiii., pp. 109-111.

sociology of some aboriginal tribes on Cape York Peninsula, in the extreme north of Queensland[7].

All the tribes mentioned in the last paragraph have *four* intermarrying sections in their social structure. But in the north-west corner of Queensland, fronting the Gulf of Carpentaria and adjoining the boundary of the Northern Territory, there are some tribes which comprise *eight* intermarrying divisions, for a description of which the reader is referred to volume xx of this journal, pp. 65-68 ; volume xxxii of the journal of the Royal Society of New South Wales (1898), pp. 251-252 ; and Volume I., New Series, American Anthropologist (1899), pp. 595-597. I was the first author, and as far as I am aware, the only one, who has reported the eight section system in Queensland.

It may be stated here, what I have repeated in several scientific journals, that my object in recording the languages, initiation ceremonies, and sociology of the aborigines of Queensland is to induce other writers to embark on the same lines of investigation.

CORRECTIONS.

My article in Vol XX of this Journal requires the following corrections :—

Page 51, line 9 ; and page 52, line 24 ; for "exogamous" *read* "principal."

Page 52, bottom line, for "Mumbirra" *read* "Bumbirra."

Page 53, line 12, for "Muggulu" *read* "Merugulli," and at line 29, for "Merugulli" *read* "Muggulu."

Page 73, line 27, for "he" read "be."

Page 74, line 21, for "organiation" *read* "organisation"

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7 *Ibid.*, xxxiv., pp. 131-135.

NOTES ON THE ABORIGINES OF THE NORTHERN TERRITORY, WESTERN AUSTRALIA AND QUEENSLAND.*

By R. H. MATHEWS, L.S.

In this short paper are collated a few important notes respecting intermarriage, descent, and other customs of some Australian tribes. As the information relates to three States of the Commonwealth, the paper is divided into separate portions dealing with the aborigines of each one by itself.

PART I.—THE NORTHERN TERRITORY.

SYNOPSIS.—Sociology and beliefs of the Chingalee tribe. Circumcision among the Chauan tribe. Nose boring. Stone implements and boomerangs. Useful timbers.

Sociology of the Chingalee Tribe.—In volume xvi. of this journal, 1900-1, at p. 72, I gave a list of the names of the eight sections of the Chingalee tribe, which occupies the country about Daly waters, Powell's Creek, and Newcastle Waters in the Northern Territory. On the present occasion I shall arrange the subdivisions in tabular form. The names in this table are the same as those given in my former article, excepting that I have omitted the termination *inja,* which is common to nearly all of them, in order that they may occupy less space.

TABLE I.

Cycle	Mother.	Father.	Son.	Daughter.
A	Nungalee	Chimitcha	Taralee	Naralee
	Nala	Chuna	Tungaree	Nungaree
	Naralee	Chemara	Chula	Nala
	Nungaree	Champachina	Chungalee	Nungalee
B	Namitcha	Chungalee	Champachina	Nampachina
	Nana	Chula	Chemara	Nemara
	Nampachina	Tungaree	Chuna	Nana
	Nemara	Taralee	Chimitcha	Namitcha

The women of the community can be classified into two cycles, each of which contains four specific sections. The children, boys and girls alike, inherit the same cycle as their mothers, but take a different section, the name of which is regulated by the section to which the mother belongs Taking an example from Cycle A in the above table, if Chimitcha wed a Nungalee, as in the table, his children will be Taralee and Naralee ; if he take a Nala spouse, they will be Tun-

* Read before the Royal Geographical Society of Australasia, Queensland, June 6, 1907.

garee and Nungaree ; if he choose a Nana the offspring will be Chemara and Nemara ; and if his wife be a Namitcha, then his family will be Champachina and Nampachina.

We have just seen that a man may have a wife belonging to any one of four sections, and that the denomination of his family would vary accordingly. Although a woman may likewise have a husband from any one of four sections this fact makes no difference at all to her progeny. For example, a Nungalee woman might be married to a Chimitcha, or a Chuna, or a Chula, or a Chungalee, but her children would be Taralee and Naralee just the same, because the succession of the sections through the mother is absolutely invariable. In other words, succession cannot possibly be counted through the father.

The following table illustrates another important detail of the sociology of the Chingalee tribe, which has never yet been published. The section name of a male or female who has passed through the ceremonies connected with the attainment of puberty is different from the section name which he or she bore from birth up to that time.

TABLE II.

	Feminine Section Name.		Masculine Section Name.	
Cycle	At Puberty.	Before Puberty.	At Puberty.	Before Puberty.
A	Nungalee	Ongalla	Chungalee	Chukala
	Nala	Arlinginju	Chula	Chulamah
	Naralee	Ehralee	Taralee	Tapala
	Nungaree	Ambadee	Tungaree	Chupadee
B	Namitcha	Narbeeta	Chimitcha	Chuckadé
	Nana	Ahmana	Chuna	Chunamah
	Nampachina	Nabachakadu	Champachina	Tampalillee
	Nemara	Chupadinnee	Chemara	Chumadé

Among the Warramonga blacks who adjoin the Chingalee on the south, we find that the adult section name Taponunga is known as Luanagu from birth to puberty ; Jungulla is Takala ; Kubadjee is called Toopalaree until puberty is reached, and so on. See my table of the adult section names of the Warramonga tribe in Vol. XVI of this Journal, p. 74.

When describing the sociology of the Binbingha and Wombaia tribes in vol. xx of this journal, pages 71-73, I reported some peculiar beliefs relating to conception. The Chingalee share the same belief that children are not the result of the commerce of the sexes, but the details of this important function are somewhat different. When a woman first becomes aware of her pregnancy, she communicates the fact to her husband. As soon afterwards as a suitable opportunity occurs, he reports that when he and his wife were sleeping at such or

such a place, he dreamt that, just before daylight, he heard some little children laughing among the foliage of a tree close to his camp. Presently he felt something pulling his hair and heard a child's voice asking him to find a mother for it. He pointed to his sleeping wife, who was lying near him, and the tiny infant disappeared.

These spirits or spirit children, have their regular homes at certain fixed spots, but they ramble about and visit their old camping places, temporarily resting in trees growing near watercourses. When a spirit has obtained a mother in the way described, and the time arrives for the birth of the child, it is found to be of the opposite sex to that of the ancestor. For example, if the spirit had before animated a man's body, when it is re-born it will be a woman's spirit, and so on at each re-birth alternately. The child will be allotted the totem belonging to the locality of the alleged dream, because it is supposed to have entered the woman's body on that occasion.

Among the Kwarranjee, a south-western branch of the Chingalee, when a woman becomes conscious of the approach of the maternal function, she reports that she had a dream. A woman who was interrogated by one of my correspondents made the following statement. She dreamt that she followed a snake's track through the bush for some distance and came across an infant lying on the ground. She went back, in her dream, and told another woman, who came with her and also saw the child. While the two women were looking about trying to find its mother and wondering where she could be, the woman awoke. Some days afterwards she felt a child moving in her womb and when it was born it was given the snake totem.

These people say that dreaming about finding infants belongs to the women's department, thus differing from the Wombaia, Binbingha, and others who mostly attribute the dreaming to the men. Another difference is that the Kwarranjee believe that the spirit which is re-born is of the same sex as the ancestor, who is always a male—the re-birth not extending to women. In some of the northern parts of the Chingalee territory the natives believe that the spirit which enters a woman's body is not that of an ancestor, but is an entirely new or original being, which comes out of a tree or a rock haunted by spirit children. When the child is born it is allotted its totem according to the locality, the same as in the Wombaia and Kwarranjee. When the individual dies, the spirit is never born again, but wanders about its old haunts for a while, and then goes away northward.

Circumcision at Katherine River.—Among the Chau-an tribe on the Katherine river subincision of the male organ is not practised, but only circumcision. A correspondent who has been in that dis-

trict for many years past sends me the following account of how it is done. No attempt is made to keep the women and children away, as in the Chingalee, Binbingha, Warramonga, and other tribes where both circumcision and subincision are in vogue[1], but the rite is performed in the main camp. Another point of difference is that a woman forms an integral part of the final ceremony. She is placed on the ground in a crouching attitude, much in the way that a dog lies down on a mat, and is covered over with rugs or blankets. The three or four men whose backs form the "operating table" surround the woman, bending their bodies forward towards the centre, where their heads meet or overlap. The woman doess not contribute towards supporting the weight of the novice ; the men bend over her without touching her. I was unable to gather the relationship of the woman to the patients. After the ceremony a superficial incision is made along the back of the two first fingers of the right hand of the youths, the cut extending from the second joint of each finger to the hand. The incision is little more than skin deep, and scarcely shows when healed.

Nose-boring.—The septum of the nose is pierced in both sexes among the natives of the Katherine river and from there to Port Darwin. The custom is also in force at Elsey Creek, Daly Waters, Powell's Creek, and all the way along the valley of the Victoria river, extending also into Western Australia. It also obtains on the Upper Roper, Hodgson, Wilton, and other streams. A smooth bone or segment of spear-grass is usually worn as a piece of personal ornament.

Stone Implements and *Boomerangs.*—Daly Waters is mostly plain country and has no suitable stone for making implements. The tomahawks are imported from somewhere westerly of Barrow Creek and also from the Wilton river, a tributary of the Roper. The stone knives and spear heads are obtained from the country about Newcastle Waters. Stone chisels are often made of a kind of jasper found on the plains about Daly Waters and elsewehre.

My correspondents have never seen the natives throwing the "come-back" boomerang, and do not think it is in use within the above area, although there are two or three kinds of hunting or fighting boomerangs made.

Useful Timbers.—On the Victorian river and its hinterland on either side the following timber trees grow, and are used by station owners in the building of dwellings :—Bloodwood, red-gum, white-gum or carbeen, tea-tree, pear-tree, freshwater mangrove, coolaba, and Leichhardt pine. Lancewood grows in patches in the

1. See my full account of these two rites in Proc. Amer. Philos. Soc., Philadelphia, vol. xxxix., pp. 622-628.

desert and is rather scarce. In erecting yards for stock, bloodwood and coolaba make the best posts and lancewood is used for rails. Leichhardt pine is excellent wood for sawing into boards for building purposes, because the white ants do not attack it.

PART II.—WESTERN AUSTRALIA.

SYNOPSIS.—Sociology among tribes at Erlistoun and district. Beliefs about conception and rebirth. Circumcision. Extraction of front teeth. Bullroarers.

Sociology.—In articles contributed to several learned Societies during the past nine years, I have described the sociology found among the native tribes of the greater part of Western Australia, and beg to refer the student to those works[1]. In the present paper I wish to add the sociology of some tribes in the country around Malcolm, Erlistoun, Lake Wells and other places in the Mount Margaret goldfield, where the natives are divided into four intermarrying sections, as under :—

TABLE III.

Cycle.	Mother.	Father.	Children.
A	Boolgooloo[2]	Turraroo	Booroonga
	Booroonga	Kurramurra	Boolgooloo
B	Turraroo[3]	Boolgooloo	Kurramurra
	Kurramurra	Booroonga	Turraroo

The whole tribe is nominally divided into two cycles, A and B, and each of these is subdivided into two sections. A cycle therefore contains two sections of women, who reproduce each other in continuous alternation. For example, Boolgooloo produces Booroonga, and Booroonga produces Boolgooloo for ever. The normal rules of marriage are as indicated in the table, that is, a Turraroo man marries a Boolgooloo woman, and the children, boys as well as girls, are Booroonga. A Turraroo man could, under certain conditions, wed a Turraroo woman and the children would then belong to the Kurramurra section. It is evident therefore that the descent of the progeny is determined through the mother. Again, a Kurramurra man usually marries a Booroonga woman, but he could, in some cases, take a Kurramurra wife, and the section name of the progeny would vary as before. It is evident, then, that the men of the sections Turraroo and Kurra-

1. Divisions of some Western Australian Tribes, American Anthropologist, ii., N.S., pp. 185-187. Native Tribes of Western Australia, Proc. Amer. Philos. Soc., Philadelphia, xxxix., pp. 123-125; *Ibid.*, xlix., pp. 32-35. Ethnological Notes on the Aboriginal Tribes of Western Australia, Queensland Geographical Journal, xix., pp. 45-72.

2. This name is a variation of Boogarloo or Boogooloo, reported by me in 1900 as one of the four section names occurring among the tribes on the Murchison, Gascoyne, and other rivers.

3. Turraroo is in place of Paljarri of the tribes further to the north-west.

murra, taken collectively, could marry not only both sections in Cycle A, but they could marry both sections in Cycle B. In other words, these two sections of men, collectively, could marry all the women in the community. The same laws apply to the lower half of Table III.

These Mt. Margaret tribes do not believe that the intercourse of the sexes is the cause of the birth of children. Spirits of children have their home among the leaves of trees growing near springs or waterholes. If a man and his wife camp all night near one of these haunted trees, a spirit child may come down shortly before dawn and enter the woman's body through the mouth or navel or any other part. The husband may dream that he hears the infant laughing or singing amongst the leaves just before it starts down. These spirits are only born once of a human mother, and when their human career is finished they go away, or prowl about as evil spirits, or as we would say, become ghosts.

Dr. Scott Nind, who was medical officer of a small settlement at King George's Sound from 1827 to 1829, prepared an account of the aborigines of the surrounding country. Speaking of their sociology he says: "The whole body of the natives are divided into two classes (sections), Erniung and Taaman, and the chief regulation is that these classes must intermarry; that is, an Erniung with a Taaman. The children always follow the denomination of the mother. Thus, a man who is Erniung will have all his children Taaman, but his sister's children will be Erniungs."[1] This statement can be tabulated as follows:—

TABLE IV.

Cycle	Mother.	Father.	Offspring
A	Taaman	Erniung	Taaman
B	Erniung	Taaman	Erniung

Such a classification as this would separate the community into two cycles, on the same principle as the Barkunjee tribes of New South Wales.[2]

Mr. E. M. Curr, in 1886, was the next author to deal with the tribes in the Albany or King George's Sound district. He says: "Class marriage prevails, the two principal divisions being Munichmat, or those of the white cockatoo, and Wordongmat, or those of the crow."[3]

In 1903 I sent circulars to a number of old residents of the Albany district, asking them to undertake certain inquiries respecting

1. Journal Royal Geographical Society (London, 1831), I, pp. 37-44.
2. Journal Royal Society, N. S. Wales, XXXIX, p. 118.
3. The Australian Race (Melbourne 1886), I, p. 386.

the sociology and customs of the natives. Mr. Thos. Muir, J.P., was the only one who responded to my request. He confirmed Mr. Curr's statement regarding the names of the two divisions and stated that descent was reckoned through the father; that is, that a Munnitchmat husband had Munnitchmat children and that a Wurtungmat man's children were Wurtungmat like himself. Knowing that Dr. Nind had reported that descent depended upon the mother, I prepared a table embodying Mr. Muir's conclusions and sent it back to him with a request that he would further interview the blacks. I suggested that perhaps descent was regulated by the women, but he persisted in his first statement, which he said was "exactly right." I therefore published the table, throwing all the responsibility of the line of descent upon Mr. Muir.[1]

In 1905 Mrs. D. M. Bates[2] made some investigations among the the blacks in that part of Western Australia and confirmed the divisional names reported by Mr. Curr and myself, but said that descent was counted through the mothers, being the same as Dr. Nind had originally reported. Last year I drew Mr. Muir's attention to Mrs. Bates's conclusions, but after once more referring to the blacks he still adhered to his former statement. I may state that from the first he also contraverted the accuracy of Dr. Nind's account.

In Dr. Nind's paper, in addition to Erniung and Taaman he mentions Moncalon, Torndirrup, Opperheip, Cambien, Mahnur, etc., some of whom have male descent. Among the natives of Perth, Sir George Grey and other early writers mention such names as Mongalong, Tondarup, Ballaroke, etc., and Mrs. Bates in 1905 speaks of some of these names, with others. From the information before us it is impossible to arrive at any definite conclusion regarding the sociology. I am, however, of opinion that the names just mentioned, as well as Munnitchmat and Wurtungmat, are designations of clans or triblets, whose hunting grounds and ceremonial rites devolve through the man in the usual way. The descent of the children and of the totems I leave an open question for the present.

Some Other Customs.—In the Mt. Margaret district all the men are circumcised, and in addition the urethra is split down for about an inch and a half from the meatus. The corresponding mutilation of vulvotomy is performed on the women before they are eligible as wives.

A front tooth is extracted and the nasal septum pierced, but both these operations are confined to the men; about Erlistoun it is very rarely that a woman is seen wearing a nose-peg or having a tooth missing. Infants are betrothed at the time of their birth in the usual

1. Queensland Geographical Journal, XIX, p, 51.
2. Victorian Geographical Journal, XXIII, p. 43.

way. "Come-back" boomerangs are now in use among these blacks, and they say they were known before the advent of Europeans.

Bullroarers.—The mystic "bullroarer," so well known among Australian tribes everywhere, is also used by the aborigines of Western Australia in their secret ceremonies of every description. One of my correspondents in the Hall's Creek district informs me that the natives there have certain unfrequented spots where their bullroarers are secreted when not in use. These hiding places are generally in caves or recesses under overhanging ledges of rock, situated in hilly or broken country. Each initiated man is supposed to be the owner of one of these instruments. Soon after a male child is born, a bullroarer is provided for him by one of his relatives and is kept until he is circumcised, when it is presented to him. He keeps it for a time, after which it is planted away with the bullroarers belonging to other members of the local division of his tribe.

A bullroarer is provided for a boy in the following manner. The old men assemble and discuss all the circumstances of the birth, chiefly as regards the spot where the infant was first dreamt of, which we shall assume to be near a tree A, known to be haunted by Crow spirits, from which the Crow totem is allotted to the boy. If any Crow man of that local division has died either recently or during some years past, leaving his bullroarer in its well known hiding place, as above stated, it is conferred upon the newly born boy. The deceased Crow man would, however, have to be a person whose spirit had come from the tree A or at any rate not far from it, questions of pedigree being likewise taken into account. If such a man's instrument had already been given to an earlier birth, and no more are available, then a new one would have to be manufactured for the boy of our example.

These bullroarers are mostly made of wood, ornamented with engraved lines on their flat surfaces, but instruments are sometimes met with which consist of thin pieces of slate similarly marked. A bullroarer is never made for a female child, nor is one ever deposited in a cave or elsewhere on behalf of any grown up woman.*

Mr. L. A. Wells, states that at Joanna Spring, about 130 miles south from Fitzroy river, Western Australia, he found two bundles of bullroarers, each bundle containing about twenty flat pieces of carved wood, with holes at one end. These ranged from very old ones to some made recently. They were hidden beneath some bushes, with a quantity of leaves placed under each bundle to protect it from the ravages of white ants. He says: "My black-boys informed me that

* A correspondent residing on the Upper Finke river in the Northern Territory informs me that among the Aranda tribe in that district, a *tjurunga* or kind of bullroarer is made for every child, girls as well as boys, but a girl never sees her *tjurunga*.

they were used during the initiation of young men, when a new one was made for each candidate. The old ones, they said, belonged to the elder men."[1]

PART III.—QUEENSLAND.

SYNOPSIS.—Sociology of the Kittabool tribe and of the Turrubul tribe at Brisbane. Sociology of tribes on Burnett, Mary, Dawson, and Condamine rivers. All these tribes have descent through the mothers only.

In Volume xx of this journal I gave a description of the sociology of the Murawarri, Baddyeri, Wonkamurra, and other tribes in south-western Queensland, as well as of some tribes from Camooweal and Barklay's Tableland to the Gulf of Carpentaria.

In the following pages I shall deal with the sociology of some aboriginal tribes of the south eastern end of Queensland, from Beenleigh along the coast to Port Curtis, extending inland from 150 to 200 miles. This tract of country comprises the entire basins of the Logan, Bremer, Brisbane, Mary and Burnett rivers, as well as the Condamine river down to Condamine town and the Dawson river down beyond Banana. All the tribes in that area are divided into four sections, bearing the following names, viz. :—Bar′-rang, Ban′-dyoor, Dyer′-wain, and Bun′-da. On the Mary and Burnett rivers, Balkuin is used instead of Bandyoor.

In the years 1872-3-4, I resided at Deepwater and Tenterfield, in the New England district of New South Wales, and frequently visited Stanthorpe and Woodenbong on my way to Warwick and Brisbane. In 1875 and 1876 I was living at Goondiwindi, and often went to Warwick, which was then the terminus of the railway from Brisbane. In this way I made the acquaintance of many of the members of the Kittabool and Wawpah tribes, a circumstance which was valuable to me in later years when I had more leisure.

The Kittabool speaking people had their home about Woodenbong, on the sources of the Clarence and Richmond rivers, in New South Wales, but extended northerly over the Queensland frontier to the sources of the Logan river. On the south they were bounded by the Bunjellung tribe about Drake and Tabulam on the Clarence river. Northwest of the Kittabool was the country of the Wawpa tribe, including Warwick, Leyburn, Pike's Creek, Inglewood, and Stanthorpe. Branches of the Wawpa tribe, all speaking the Wawpa language or dialects of it, reached away northerly as far perhaps as Dalby.

1. Proc. Roy. Geog. Soc., South Australia, vol. iii., pp. 169-170.

The following table exhibits the four sections of the Kittabool, obtained direct from the natives when I revisited them in 1898:

TABLE V.

Cycle.	Mother.	Father.	Son.	Daughter.
Kar′-pe-un	Barrangan	Dyerwain	Bandyoor	Bandyooran
	Bandyooran	Bunda	Barrang	Barrangan
Dee′-a-dyee	Dyerwaingan	Barrang	Bunda	Bundagan
	Bundagan	Bandyoor	Dyerwain	Dyerwaingan

The above table gives the cycle, mother, father, son and daughter, on the same line from left to right. Intermarriages are regulated as follows: A man of the Deeadyee cycle and Dyerwain section, marries a woman of the Karpeun cycle and Barrangan section, who may be called wife No. 1. This is the normal rule of marriage. But Dyerwain of another pedigree could instead espouse a Bandyooran, whom we shall call his No. 2 wife. Another variation in the intermarriages of the sections allows a Dyerwain to take a wife, who is a Dyerwaingan —a woman of his own cycle—who may be distinguished as No. 3. Again, Dyerwain could marry Bundagan, whom we shall call No. 4.

Of the four marriages just mentioned, No. 1 and No. 3 wives are the most usual; Nos. 2 and 4 being more or less uncommon. If Dyerwain marries Barrangan, as in Table V., his children are Bandyoor and Bandyooran; if he weds Bandyooran they are Barrang and Barrangan; if he takes Dyerwaingan they are Bunda and Bundagan; and if his wife be Bundagan his offspring will be Dyerwain and Dyerwaingan. That is, the section name is invariably determined through the women.

Examination of the table shows that although the children follow the cycle of the mother, they do not bear the name of her section, but that of the supplementary section, because the women of a cycle reproduce each other in continuous alternation. Moreover, the totems remain in the same cycle as the women and are transmitted accordingly from a mother to her progeny.

Among the Kittabool blacks I obtained a reliable list of totems. The cycle Karpeun has: Rosella parrot, kangaroo-rat, carpet snake, emu with dark head, brown kangaroo, opossum, codfish, crow, porcupine, and brown dingo. To the cycle Deeadyee belong: Wallaroo, plain turkey, magpie, black snake, whip-tail kangaroo, iguana, emu with light coloured head, tan coloured dingo. At the time I collected these totems, 1898, I had not discovered the "blood divisions," reported by me as existing in the Ngeumba and other tribes[1], but judging from the different colours in the emus and dogs in the above list, I think it probable that there are similar divisions among the Kittabool.

1. Journ. Roy. Soc. N.S. Wales, xxxviii. 209-215.

The totems of a cycle are common to both the sections of it, and are handed down from a mother to her children, as already stated.

Old men of the Kittabool tribe assured me that the same social organisation as that existing among them extended to Beenleigh, Ipswich, and Brisbane, where the names of the four sections were identical among the Turrubul tribe. This is corroborated by Rev. Wm. Ridley in 1855 and 1866, when dealing with the Turrubul, "the language spoken on the Brisbane river[1]." His spelling of the sections is Derwain, Bunda, Barang, and Bandur. He says: "At Moreton Bay[2], the wife of a Derwain is Derwaingun." This is my No. 3 marriage. Again, he says: "The son of a Bandur is Derwain." This is the case where Bandyoor marries Bundagan, my No. 1. "The son of a Barang also is Derwain." This is where Barrang marries Bundagun, my No. 2. See Table V. Mr. Ridley continues: "Sometimes the son of a Derwain is Bunda." This is where Derwain marries Derwaingan, my No. 3 wife. "Sometimes the son of Derwain is called Barang." This is where Derwain marries Bandyooran, which is my No. 2 wife.

It appears, then, that Mr. Ridley observed among the Turrubul blacks, the intermarriages which I have called Nos. 1, 2 and 3 as far back at least as 1866. I reported similar marriages in 1898, when describing the sociology of the Dippil nation, in which I included the Turrubul[3]. Mr. T. Petrie also confirms my report of the sociology of the Turrubul tribe. In a letter to me in 1898 replying to my inquiries, he says: "The natives I know are the Brisbane blacks—the Turrubul tribe. I had no experience of them farther south than the Logan, but as far as that river I found them just the same as those north to Wide Bay—the same classes, etc." In his *Reminiscences*, p. 202, Mr. Petrie says: "Banjur was a class name of the Turrbul tribe[4]." He also mentions Turrwan, apparently a variation of Mr. Ridley's Derwain and my Dyerwain.

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1. "Journal of a Missionary Tour among the Aborigines of Queensland in 1855, by Rev. Wm. Ridley, reprinted in Dr. John D. Lang's "Queensland" (London 1861), p. 436. See also "Kamilaroi, Dippil and Turrubul Languages" by Rev. Wm Ridley (Sydney 1866), pp. 38 and 73. Mr. Ridley again repeats his statement in 1875, in his "Kamilaroi and Other Australian Languages," p. 163. That is, in 1855, 1866, and 1875, he reports the existence of four intermarrying sections in the Turrubul tribe.

2. Moreton Bay was the name by which Brisbane was known in the early days. See also T. Petrie's "Reminiscences," p. 141.

3. Proc. Amer. Philos. Soc., Phila., xxxvii, 328-333, with map.

4. Mr. T. Petrie in his "Reminiscences" uses *Turrbul* as the name of the same tribe which Rev. W. Ridley, an eminent linguist, gives as *Turrubul*. In justice to Mr. Petrie I must say that in his letter to me in 1898, above quoted, he writes the word *Turrubul*, the same as Mr. Ridley. All the Kittabool and Wawpa blacks whom I have met pronounced the word in the same way. Mr. Petrie uses the word "classes" for the divisions which I call "sections."

Mr. Edward Palmer[1], in 1883, when reporting the section names Bunda, Therwain, Baring and Balcoin, among some tribes at Rockhampton and Wide Bay, says: "These classes (sections) occur, with some little variations, at Moreton Bay (Brisbane)."

If we proceed northward from the Kittabool tribe, it is found on reaching approximately the 27th parallel of latitude, that although the four sections have the same names, their normal or No. 1 marriages are different from those of the Kittabool, as exemplified in the following table.

TABLE VI.

Cycle.	Mother.	Father.	Son.	Daughter.
Karpeun	Barrangan	Bunda	Bandyoor	Bandyooran
	Bandyooran	Dyerwain	Barrang	Barrangan
Deeadyee	Bundagan	Barrang	Dyerwain	Dyerwaingan
	Dyerwaingan	Bandyoor	Bunda	Bundagan

The variations in regard to wives Nos. 2, 3. and 4 are similar to those of the Kittabool.

When I was at Maryborough and other places in south eastern Queensland in 1898 collecting details of the "Toara Ceremony of Initiation[2]," I met some intelligent old blacks who said that the sociology of the Mary and Burnett natives was the same as at Brisbane, but the section name Bulkoin was substituted for Bandyoor, just as Boogarloo displaces Banaka among certain tribes in Western Australia[3]. This is confirmed by Rev. W. Ridley who reports that Balkoin was in use at Wide Bay in 1866[4]. It is also confirmed by Mr. E. Palmer in 1883[5] and by Rev. J. Mathew in 1899[6]. Among the natives of the Dawson river, however, Bandyoor is used, the same as in Table VI.

In an earlier page I have stated that descent of the children is counted through the mother, which is the result of my own observations among the natives. I am supported in this by Rev. W. Ridley and Rev. J. Mathew, both of whom had resided in the territory of the tribes dealt with for some years. On the other hand Dr. A. W. Howitt, in describing the sociology of some of the same tribes, asserts that descent is counted through the father. He says, however, "that while there is *male* descent in the classes (my sections), it is in the *female* line in the totems."* Such a mixture of descent has never

1. Journ. Anthrop. Inst., London, xiii, 305.
2. American Anthropologist, ii, N.S., 139-144.
3. Queensland Geographical Journal, xix, 52. See also Proc. Amer. Philos. Soc., Phila. (1900), xxxix, 124.
4. Kamilaroi, Dippil and Turrubul Languages (1866), 38.
5. Journ. Anthrop. Inst., London, xiii, 305.
6. Eaglehawk and Crow. p. 104.

* Native tribes of S. E. Australia, p. 230.

been found anywhere by me, nor have I seen it reported by any other author. On the same page he reports the carpet snake as belonging to both Bulkoin and Barrang, but remarks that it "suggests an inaccuracy." It is, however, exactly in accord with my observations —the two sections, Bulkoin (Bandyoor) and Barrang, belonging to the same cycle and consequently having the same totems.

On p. 231 of his book, Dr. Howitt thus refers to a number of tables of descent he received from Mr. H. E. Aldridge, but which he does not publish: "These differed considerably among themselves in the arrangement of the sub-classes (sections) and in the marriages and descents, so much so that the correctness of some of them seemed doubtful." There seems to me to be no question that Dr. Howitt has arrived at a wrong conclusion in regard to the descent,[1] and I am drawing attention to the matter now because on a former occasion I was misled by Dr. Howitt's conclusions respecting the line of descent in the Kaiabara tribe,[2] included in the area I am now dealing with.

Years ago I corresponded with Mr. H. E. Aldridge, quoted in last paragraph, and found that he sometimes arranged the pair of sections forming a cycle in one way, and sometimes in another. I accordingly met him by appointment and found that what I have called the Nos. 2, 3, and 4 wives had evidently bothered him when getting examples, and caused his tables to appear contradictory to any one unacquainted with the intermarrying regulations.

Perhaps I ought to say in conclusion that if any doubt exists in the mind of anthropologists as to the line of descent in the tribes treated, this matter can be quite easily settled by taking a journey from Brisbane among the remnants of the natives on the Mary, Burnett, Dawson, and Condamine rivers. I shall feel very much gratified if any competent man will adopt my suggestion, in order to confute or confirm my conclusions. It may be stated, however, that I am absolutely certain as to their correctness.

1. Proc. Amer. Philos. Soc., Phila. (1898), xxxvii., 330, with map.

2. "Queensland Geographical Journal," x., 29.

EMPIRE AND COLONIES: ANNIVERSARY ADDRESS TO THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.*

By HIS EXCELLENCY THE RIGHT HON. LORD CHELMSFORD, K.C.M.G., President.

I shall not make any apology for my choice of subject to-night. A President's address is frequently a resumé of the Geographical work of the past year, but for this I should have to depend entirely on the work of others. I have chosen, therefore, a subject which has always had a fascination for me—" Empire and Colonies."

I do not think the subject can be regarded as beyond the scope of this society, though my treatment of it will rather be within the sphere of political philosophy than that of geography.

This Society considers problems which affect the welfare and prosperity of this State—Irrigation—The Pastoral Industry and such like are all cognate to its existence and its discussions.

The Empire and the existence of Queensland as a constituent part are similarly to my mind problems which concern it, none the less that Great Britain and Queensland are at the antipodes the one to the other—a fact which largely affects our consideration of the problem.

And in the second place the Imperial Conference which has lately concluded its labours almost provokes such a discussion.

Again my own position perhaps make me dwell with greater interest on these wider questions whose investigation and consideration cannot but be prompted and stimulated by sojourn in and a greater knowledge of the countries of the Empire. For these reasons I have chosen this subject. I need hardly say that my treatment of it is more on the side of the philosophy of history than of practical politics. For strait is the way and narrow the path wherein a Governor has to walk.

But there are many roads leading out from it down which other members of the Society possessed of greater freedom of speech might saunter, and I hope my paper may induce them to step these walks.

What better subjects for a Geographical Society to consider than a mail or cable route, or the question of subsidies to steamships. These are the links of Empire and there is no more practical lesson in geography than that which makes you follow a ship on the map.

There are few subjects worth considering under the sun in which it is wise to ignore Greek thought, and therefore though there never was in fact a Greek Empire, there were Greek Colonies, and for a moment I will dwell on the principle underlying Greek Colonization.

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* Delivered at the Annual General Meeting of the Royal Geographical Society of Australasia, Queensland. July 30, 1907.

The Greek Colonies—if any one will take the trouble to consult Professor Freeman's historical geography, he can see it for himself occupied most of the pleasant places round the coast of the Mediterranean Sea, but the important point to be observed in this connection is not the extent of territory so occupied, but the political theory underlying these settlements.

The Greek equivalent for Colony was ἀποικία, a word signifying away from home. The word itself shows the significance attached by the Greeks to settlements away from the Mother Country. These settlements as a rule were not dependent communities, though the sense of kindred commonly held them in a condition of permanent alliance to the mother city. The Greeks regarded the city and the State as identical, indeed their language only contained one word for the two, and Aristotle laid it down as a principle that the State must be of moderate population because who could command it in war if the population were excessive, or what herald short of a Stentor could speak to them.

It is obvious therefore from this conception of the State that strict political ties were impossible between the great mother cities and their offshoots, and that those who went out from the mother city undertook to form a new city and a new State separate from the mother city.

The truth is that while the modern State in its organization admits of unbounded territorial extension, the organisation of the ancient State did not.

I pass over the Empire next in chronological order—that of Alexander the Great. It rested mainly on conquest and not on colonization, and its speedy disruption on the death of its founder shows it had no unifying or colonising principles and consequently no lesson for us.

I next come to the Roman Empire, and it is scarcely necessary for me to describe to you its extent. It comprised by far the greater part of the then known world, and it is easy for those who wish, to find it outlined on any ancient map ; but its importance to us is based not so much on its extent, wide though it was, as on its influence on the world's history, and no more than in the case of Greece can we afford to pass by Rome.

The Roman Colonia was something quite of its own kind. As Seeley describes it, it was a sort of contrivance through the settlement of old soldiers on the boundaries of the Empire, for the purpose of garrisoning conquered territory without the expense of maintaining an army there. The expression Imperium, (from which our word Empire is derived), as Mr. Bernard Holland puts it in his suggestive

book. " Imperium et Libertas," to which I am much indebted, signified neither geographic space nor population, but in the earlier times a military and subsequently a political *power*, whether exercised by an individual or a state. The Roman Colonies were like garrisons in subject territory, and their colonists *unlike* the Greeks, who, as I have mentioned, carried away no true political connection with their mother city, remained strictly subject to the Roman imperium.

The causes leading to the break up of the Roman Empire are still the subject of controversy, but one cause, at least, may be given with a great show of reason, and that was the over-centralization of the Government, and the undue preference given to the metropolis as against the Provinces.

We pass next, for it is impossible, with the short time at our disposal, to dwell at length on any one point, to four colonial Empires which are now in the limbo of the past, but which in their time were great, and promised to be greater still.

The earliest in point of time was that of Portugal.

Henry the Navigator—the first patron of geographical discovery ; Vasco da Gama—the discoverer of the route to India round the Cape ; Cabral—the discoverer of Brazil ; Albuequerque—the first Viceroy of the Indies, are all honoured names in the history of geography and discovery.

Nor were their discoveries without tangible result to this country Portugal.

In America Brazil came to be hers ; in Africa she had settlements on the Gold Coast, and became dominant on the East Coast.

In India she acquired Goa and large tracts of country.

She possessed Ceylon, Malacca, the Moluccas, and countless other islands in the East, and all this before the British Empire was thought of or indeed begun.

A schoolroom acquaintance with history will bring to our minds the once great *Empire of Spain.*

Few of us have not followed Cortez and Pizarro in their conquests of Mexico and Peru, and the stories of Elizabeth and her sea captains will remind us of the silver fleets which brought the wealth of the new world to Spain.

Though we chiefly remember Magellan from the Straits which bear his name, it was he who added those Islands, the Philippines, which now belong to the United States, to the Spanish Empire.

Spain at her zenith possessed in fact the greater part of South and central America, with the exception of Brazil, which as I have said belonged to Portugal, Cuba and the Philippines. And sanction was given to this possession by the famous bull of Alexander VI.

which granted to Spain all discoveries west of an imaginary line drawn 100 leagues to the west of the Azores and the Cape Verde Islands.

Of all this great Empire, there is now only left to Spain the Canary Islands, and some 90,000 sq. miles on the coast of Africa, but her influence may still be traced in the fact that next to the English language, Spanish is probably spoken by more people than any other European language.

France too has had her Empire.

As Sir John Seeley describes it, " About the same time that James I. was giving Charters to Virginia and New England, the French were founding further north the two settlements of Acadie and Canada, and again about the time that William Penn got his Charter for Pennsylvania from Charles II., the Frenchman La Salle by one of the greatest feats of discovery made his way from the great lakes to the sources of the Mississippi, and putting his boats upon the stream, descended the whole vast river to the Gulf of Mexico, laying open a great territory which immediately became the French Colony of Louisiana."

In India also the French were our rivals, and actually had the start of us, and everything pointed to French rather than British domination in that vast country.

The Empire of Holland is the last Colonial Empire to which I shall allude before coming to our own, and it is particularly interesting, because unlike the three Empires to which I have referred, Holland still holds a large portion of its former possessions.

Java, a great part of Borneo, Sumatra, the Celebes, and the Moluccas still belong to her, and for Australians there is this additional interest, that these places all lie within the Australian sphere of interest.

The Empire of Holland has been described by Mr. Lord in his book " The Lost Empires of the Modern World " as a miracle of shopkeeping. The Dutch Nation, he says, went into the business of Empire as they might have gone into any other trade, and in the course of it they amassed great wealth.

The Dutch encountered no such difficulties as Portugal or Spain had to face, in the exploration of unknown seas, or the conquest of organised nations, for they entered late on their career of expansion. But this in itself was a considerable handicap, for France and England were both beginning about the same time to extend their Empires.

Yet we find Holland in addition to those lands which I have enumerated in possession of the Cape of Good Hope, the West Indian Islands of Jamaica, and Curacoa, and Ceylon.

It is not easy in a sentence to describe the genius of these various Empires, but shortly we may say the Portuguese were the great dis-

coverers and explorers of the world, the Spaniards carried the rule of their church with them in their conquests, the French fascinated and left indelible traces of their occupation on their subjects, and the Dutch had an unrivalled capacity for making material profit out of their Empire.

And yet despite these high qualities their Empires have passed away; some through war, some through decay in the governing qualities of the rulers and consequent revolt on the part of the provinces. But one feature stands out in the history of these Empires. The Government was in every case highly centralized. There was no opportunity given to the provinces for self government, and too often the provinces were bled for the profit of the mother land.

It is perhaps idle to expect theories of Government in advance of the thoughts and opinions of an age; we also have not much cause for boasting inasmuch as we too lost the greatest part of our earliest Empire—I refer to the United States—by reason of this self same fault which we observe in these Empires of the past.

With the loss of the American Colonies in 1783 the first stage of England's experiment in Empire came to an end. For we must remember that but little of that which now makes up the Empire at that date belonged to England.

Warren Hastings had but just laid the foundation of the Indian Empire. Captain Cook had surveyed New Zealand and portions of the coasts of Australia, but there was no settlement as yet here. The Cape still belonged to the Dutch, and Canada consisted of a few isolated settlements whose existence was precarious in view of the expulsion of England from the territories of the United States.

It is scarcely to be wondered at that after the loss of America the English people fell into a kind of disgust with colonial matters, and that for the next half century, though they were attentive to the development and administration of the Indian Empire, colonial affairs, except in connection with the slave question, attracted little attention.

I shall not pursue the growth of the new Empire, as we now know it, though it is interesting to note at various stages of its development, the effect of the loss of the American Colonies on the attitude of statesmen towards the new Colonies, and on the principles governing their action. I shall have occasion to refer to this again later on.

We require in the first place to analyse what we mean by the British Empire.

People talk carelessly of the British Empire as if it were composed of homogeneous units to which the same principles of Government could apply or be made to apply.

There can be, as you are all probably aware, no greater mistake. For practical purposes we may classify the component parts of the Empire under three different heads.

First, the self governing units such as the United Kingdom, Canada, Australia, New Zealand, the South African Colonies, and Newfoundland, all of which were represented at the Imperial Conference.

Secondly, India, which must stand in a class by itself.

And Thirdly, the Crown Colonies, which exigencies of space will not permit me to enumerate.

The problem which I am discussing to-night has nothing to do with the last two classes.

These are and must be for some time governed and directed from the centre, though in contradistinction to the policy of the Empires which I have described earlier in this paper, there is no tribute paid by these dependencies to the mother country, nor are they regarded or treated as possessions out of which profit is to be made.

Our real concern to-night is the relations between the self-governing communities and the Empire.

In a sense Empire and self-governing communities are contradictory terms.

Empire, as you may remember from the derivation of the word, involves rule from the centre, while self-government in itself involves the principle of freedom from rule from the centre.

Our Empire is therefore evidently based on a paradox.

And yet were we to examine its history during the past 100 years we should probably find that it is due to this very paradox that the Empire has grown and developed, and seems likely to endure. Self-government has been the lubricant which has made the wheels of Empire run smoothly.

The loss of the American Colonies shattered the old idea of rule from the centre, and convinced Statesmen that they were on the wrong tack, and that event, to use the French phrase, gave them furiously to think that Turgot was after all right in his famous saying that "Colonies are like fruits, which will cling till they ripen."

English Statesmen therefore veered round to the opposing *Greek* idea, which I mentioned at the opening of my remarks, viz.—that Colonists took possession of new territory, and then built a city, maintaining a pious regard, except when interests clashed, for the Mother City, but not a true political connection.

However this may have been in the sixties of last century, when undoubtedly there were English Statesmen who thought that the Colonies would drop off, and that the great thing was, it should be done peacably and quietly, the logic of events was too strong for them,

and though greater powers of self-government were accorded every day, there was no disposition on the side of the Colonies to part company, and a new school of thought grew up, not only in the Mother Country, but in the Colonies, which saw in the Empire a great source of inspiration and a great power for good and strove to place it on lasting foundations.

Since 1887, the date of the first Colonial Conference, up to the present day, the feeling has been growing stronger to unite rather than to divide, and this is the feeling which we who believe in the Empire and all that it means, wish to foster to-day.

It may be said that distance stands in the way of a much closer connection than exists at present. But in the early days of English Parliamentary institutions the distances which separated the more remote constituencies from Westminster, were relatively, by reason of the difficulties of travel, equal to those which separate the Colonies from the Mother Country to-day; a fact exemplified by the allowance of 40 days within which writs were returnable, a period which was extended after the Union with Scotland to 50 days.

Mere distance is not, I think, in itself an unsurpassable barrier, especially in these days of increased facilities of communication. It is not Puck alone who can "put a girdle round about the earth in forty minutes."

No, the problem lies deeper than this. We have to satisfy the various communities, Great Britain as well as the others, which go to form the Empire, that the Empire does mean something to them, is of value to them, and that their lives and their existence would be the poorer without it.

I believe that this feeling exists not only in the Mother Country, but in her daughter States, but we want some formula by which we can give a reason for the faith that is in us.

The Compilers of the Athanasian creed knew human nature when they said, "Whoever will be saved must *thus* think of the Trinity." We all want to be told that thus and thus we are to think.

We are for the most part inarticulate, and while we have yearnings and feelings we are incapable of giving expression to them or of formulating our reasons for them.

Sir John Seeley, in his Expansion of England, felt this want, and endeavoured to find a formula which would satisfy the *English* people, and I think he found it. I quote his words :—

"The old Colonial system is gone. But in the place of it no "clear and reasoned system has been adopted. The wrong theory is 'given up, but what is the right theory? There is only one alter-"native. If the Colonies are not in the old phrase, possessions of

"England then they must be *part of England*; and we must adopt "this view in earnest. We must cease altogether to say that England "is an Island off the North-Western Coast of Europe, that it has an "area of 120,000 miles and a population of 30 odd millions. We must "cease to think that emigrants when they go to Colonies, leave "England or are lost to England. We must cease to think that the "history of England is the history of Parliament that sits at West-"minster, and that affairs which are not discussed there cannot belong "to English history. When we have accustomed ourselves to contem-"plate the whole Empire together and call it all England, we shall "see that here too is a United States."

It is to be remembered that the Expansion of England was delivered in the form of lectures to an English audience with a view to awakening a more enlightened interest among Englishmen in the Empire.

From this point of view Seeley emphasised the relationship, indeed the oneness of the Colonies and the Mother Country.

Englishmen are intensely insular, and have small capacity or opportunity while in their island home of looking far beyond its shores.

I am not convinced, however, that the formula given, or argument used by Seeley is equally applicable out here; for instance, though it may be good to tell Englishmen in order to arouse their interest "to contemplate the whole Empire together and call it all England." I doubt whether this is a taking or a sound argument to use here.

Mr. Deakin has attributed the prevailing note of sadness in Australian literature to the fact that the early writers regarded Australia as a land of exile and England as their home.

The habit of calling the Mother Country *home* always strikes an Englishman visiting these shores as a very pretty custom, and only too naturally he would not like to see it dropped.

But every year increases the number of the native born, and to them this appellation must strike a false note. *Australia* is or should be their home. Therefore Seeley's proposition to my mind requires for Australians to be recast and more broadly stated.

Don't mistake me and think that I undervalue the tie of blood and kinship and common tradition, but as a son has every wit as much right as his father to his family name, blood and family tradition, so Australians possess equally with Englishmen, the blood, history, and traditions of the past, and do not need to claim it through England, for it is theirs by birth.

But if Australians want a reason for their faith in the Empire they won't be satisfied by merely calling the Empire England, and surrounding it with all the associations of England.

After all what was the fundamental idea underlying Seeley's formula ? The idea of home and country. He felt that if he could only persuade the Englishman to regard the Empire merely as an extension of his home and country he could win his allegiance to it.

Now turning to Australia it seems to me, coming in from the outside and viewing it with fresh eyes, that the great desideratum, the great thing lacking here is this feeling of home and country, to which Seeley confidently appealed when he placed his arguments before Englishmen.

The feeling of nationality, I speak with bated breath, though growing, is not yet fully grown in Australia.

There is a great deal of talk of Australia as " God's own country," and criticism of Australia is strongly resented. But there is not yet the quiet assured faith of the poet's :

" This is my own, my native land."

The truth as applied to individuals in the saying "for he that loveth not his brother, whom he hath seen, how can he love God whom he hath not seen ? " is applicable in this case.

Until there is a strong national feeling—love for your country which you know—how can there be love for the Empire ?

The one must grow out of the other. In proportion as Australians begin to realize that their nation has grown to manhood within and under the aegis of the Empire, and this—unlike any other nation—peacefully without any baptism of blood, so will they begin to appreciate the privilege and benefit of being an integral unit of it.

The inspiration of nationality will grow into the wider inspiration of Empire.

I sometimes wish, however, that we had some other name than Empire to conjure with.

We want to find some term, some name which will embody for us that union of nations which we know as Empire.

Empire, as I showed in the beginning, connotes rule from the centre. Though this in many things, and for many purposes is the fact at present, and must be, so long at Great Britain bears the burden of Empire, yet this state of things is passing away. The old order is changing, giving place to new. There is an awakening consciousness of nationality within the Colonies, and the new order obtained recognition at the Imperial Conference, which was accepted by all as a meeting of a government with governments.

It is well to face this. but we must remember that men's minds move slowly in these matters, and it will take time for the full significance of the change to obtain acceptance.

Names die hard, and in politics continue to exist after that which they originally represented has ceased to be.

The Holy Roman Empire continued in name till 1805.

It had ceased as a reality centuries before.

So the name Empire will no doubt be used to describe the union of the Mother Country and the Colonies for many years to come, although that stage of development in which the Government was wholly from the centre has passed away. But we should be careful lest we be premature in our revision.

The English Constitution has been a plant of slow growth, and its history teaches us that it is the genius of the Anglo-Saxon race not to force developments in Constitutional growth, but to allow events to evolve in their own due time.

And so with this problem of Empire "Festina Lente" should be our motto.

It does not appear that the psychological moment for that revision has yet arrived, as anyone, who takes the trouble to peruse the Minutes of Proceedings of the Colonial Conference, may perceive.

The process which is going on is not unlike on I observed only the other day in the great Mt. Morgan copper works. The metal was in a fluid state in the great converter, and the foreman stood watching the colours of the fumes to tell the exact moment when to draw off the matte. Only the skilled workman knows that moment.

So I see the Imperial Constitution metaphorically in the converter and the Statesmen at the head of affairs watching for the magic moment.

And may they not be unequal to their task: and as the matte emerges from the converter with just the required composition, owing to the skill of the foreman, so may our Constitution emerge at the psychological moment fit to meet the new conditions and ready to bear the strain it may be called upon to bear.

And perhaps too, there will be forthcoming, some philosophical historian, a 21st century Sir John Seeley, who will draw up a new formula, which will describe how by the combination of the principle of unity of control with the principle of self-government, a union was established between the Mother Country and her daughter States on a lasting basis, a power for peace, freedom, and justice in the world, and for good to the peoples within their borders.

PROCEEDINGS

OF THE

Royal Geographical Society of Australasia,

QUEENSLAND.

22ND SESSION, 1906-1907.

REPORT OF COUNCIL.

In submitting the Twenty-Second Annual Report on the operations of the Society during the preceding financial year, the Council has pleasure in congratulating the Fellows and Members on the work accomplished since the commencement of the Session brought to a close, on the 30th June, 1907.

The Council has to allude with deep regret to the loss sustained by the death of the Hon. John Archibald, Messrs. J. H. Bean, and Thos. Mylne, who were valued ordinary members, and Mr. H. C. Russell, formerly Govt. Astronomer of New South Wales, who had for many years been one of the distinguished Honorary Corresponding Members of the Society.

The Essay received in competition for the Society's Thomson Foundation Gold Medal, having for its subject the Agricultural Industry of Australia, and to which brief reference was made in last Report, was duly examined, but not accepted. The subjects named for the next two competitions are (1) The Distribution and Economic Utility of the Artesian and Sub-Artesian Waters of Queensland ; and (2) The Economic Utility and Distribution of the Sub-Marine Fauna of Queensland. The former is to be sent in by the 1st July, 1908, and the latter by the 1st July, 1909.

The twenty-first volume of the " Journal " was issued in the early part of last Session to members and kindred societies as usual, and contained some of the most interesting and valuable papers ever published, the specially coloured maps and sections, together with other plate illustrations being a striking feature of the number, which has been welcomed in all parts of the world as an acceptable addition to current scientific literature. As formerly the demand for back numbers of the " Journal " continues, and is yearly increasing, applications being constantly received from kindred societies and other public bodies as well as from business establishments all the world over. But as the earlier volumes are now out of print, the Council finds it impossible to satisfy all the applicants without going to the expense of reprinting some of the back numbers, and this has caused disappointment to those who were anxious to have their library sets complete. In the interests of the State as well as of the Society it is felt that this is a matter for regret, seeing the important bearing of the " Journal " as a medium of communication outside of the Commonwealth, and as a means of keeping Queensland in touch with the intellectual and industrial world. The next number of the " Journal " is now in the hands of the printer, and will be brought out very shortly.

In alluding to the transactions of the past session, it is gratifying to note that the papers read at the monthly meetings covered a fairly wide variety of subjects, and represented in a satisfactory manner the scope of the Society's operations in its own particular field of activity. Taken in the order in which they were read, these papers may be briefly summarised as follows :—(1) Central Europe Revisited, by Mr. E. C. Barton. (This was illustrated by a beautiful set of lantern slides.) (2) Ocean Depths, by Capt. W. Eaton. (3) The Great Barren Jack Reservoir and Murrumbidgee Irrigation Scheme, by Dr. J. P. Thomson. This was illustrated by two large wall maps and several photographs, and embodied the results of the author's own personal investigations undertaken at the request of the Government of New South Wales. (4) The British System of Weights and Measures : A Suggested Simplification and Adaptation to the Metric System, by George Phillips, C.E. This also was illustrated by an interesting set of measuring rods or sticks cut to scale by the author, and showed very clearly the advantage of the system which he advocated. (5) The Initiation Ceremonies of the Murawarrie and other Aboriginal Tribes of Queensland, by Mr. R. H. Mathews, of Parramatta. (6) Notes on the Aborigines of the Northern Territory, Western Australia and Queensland, by Mr. R. H. Mathews, of Parramatta. To the authors of these the best thanks of the Council are due.

The abstract of accounts, herewith submitted, shows that the expenditure for the year has been exceptionally heavy, in consequence of the extra printing in connection with the last issue of the " Journal," and other matters associated with the anniversary celebrations, not included in the last statement, when the balance sheet was made out. The liabilities for the period covered by this report amount to £178 5s. 1d. These, however, have been met in full, and after paying all outstanding accounts up to date, it is extremely gratifying to report that the credit balance in the Royal Bank, and Government Savings Bank at the end of the financial year, on the 30th June last, amounted to £67 17s. 1d., showing that the general funds are in a fairly satisfactory condition. The receipts from subscriptions alone came to £129 3s. 7d. In addition to the current accounts there is the Thomson Foundation Medal Fund in the Government Savings Bank. This is deposited as a capital account, and now amounts to £243 9s. 11d., but as previously stated, requires to be brought up to £300 to be self supporting. It is however hoped that the additional sum of £56 odd will soon be contributed by members and friends of the Society, to whose liberality the Fund owes its inception and is indebted for its present state. The Gold Medal established in connection with this fund is a very handsome and valuable one. It is intended to be awarded annually or at such other times as may be decided for the best papers on special subjects or for meritorious services rendered to the Society. The last award was made to the late Sir Hugh M. Nelson, who had devoted the last years of his life to the service of the Society.

In accordance with the usual practice during the last few years the Council desires to recommend :—(1) The suspension of so much of the Rules as provides for the payment of an entrance fee. (2) The reappointment of Messrs. Alexander Muir and Robert Fraser as Un-official Members of the Council. (3) The reappointment of Mr. A. S. Kennedy as Hon. Librarian, and Mr. Robert Fraser as Hon. Auditor.

Whilst it is gratifying to allude to the satisfactory nature of the work accomplished during the period under review and to the growing influence of the Society on the intellectual and industrial life of the country at large, the Council feels

that the membership would be largely increased if the exceptional privileges and advantages offered were more widely and generally known, and the aims and objects of the Society more clearly understood. A larger membership would afford the means for wider and more extensive enterprises. In the best interests of the State this is highly desirable and should recommend itself to all intelligent citizens.

ABSTRACT OF THE ACCOUNTS OF THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

FROM 1ST JULY, 1906, to 30TH JUNE, 1907.

Dr.

	£ s. d.	£ s. d.
By Funds at close of last account—		
Balance in Govt. Savings Bank	53 7 0	
,, ,, Royal ,,	63 11 7	
		116 18 7
,, Annual Subscriptions Received ..	119 18 0	
,, Balance of Anniversary Special Refreshment Fund	7 13 10	
,, Interest on Govt. Savings Bk Deposit	1 11 9	
		129 3 7
		£246 2 2

Cr.

	£ s. d.	£ s. d.
To Expenditure as per accounts—		
Printing "Journal"	77 3 3	
Postage on "Journal"	8 18 6	
		86 1 9
Printing and Posting Notices of Meetings	10 3 0	
Advertising	1 7 3	
Expenses of Meetings, cleaning rooms, hire of chairs, postage, etc.	28 7 1	
Gas Account	1 11 8	
E. Eschenhagen—Catering Anniversary Celebration ..	5 14 0	
Hon. Secretary	25 0 0	
Typing	1 16 10	
Map Drawing	1 1 0	
General Printing..	9 2 3	
Fire Insurance Premiums ..	2 16 3	
Office Furniture	1 12 6	
Sub to "Nature" and P.O.O.	1 11 6	
Gas Fittings	1 10 0	
Bank Charges	0 10 0	
		92 3 4
		178 5 1
,, Balance in Govt. Savings Bank ..		54 16 9
,, ,, ,, Royal ,, ..		13 0 4
		£246 2 2

Examined with Bank Books, etc., and found correct.

ROBERT FRASER, *Hon. Auditor.*

J. P. THOMSON, *Hon. Secy. and Treasurer.*

Brisbane, 10th July, 1907.

Royal Geographical Society of Australasia,

QUEENSLAND.

FOUNDED 1885.

DIPLOMAS OF FELLOWSHIP.

The following gentlemen have been awarded the Diploma of Fellowship under Section IV. of Clause 3, Constitution and Rules (*See page 2 of Cover*):—

Honorary:

His Excellency Sir William MacGregor, G.C.M.G., C.B., M.D., LL.D, D.Sc., Hon. F.R.S.G.S., etc.

The Right Hon. Lord Lamington, G.C.M.G., G.C.I.E., B.A., F.R.G.S., Hon. F.R.S.G.S., etc.

Under subsections (a and b):—

Lieut.-Col. James Irving, P.V.O., Q.D.F., M R.C.V.S.I.
J. A. Baxendell, Esq.
Charles Battersby, Esq., J.P.
Robert Fraser, Esq., J.P.
Rev. W. M. Walsh, P.P.
E. M. Waraker, Esq., J.P.
R. M. Collins, Esq., J.P.
Alexander Muir, Esq., J.P.
C. B. Lethem, Esq., C.E.
John Cameron, Esq., M.L.A.
Hon. Arthur Morgan, M.L.C.
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Hon. F. T. Brentnall, M.L.C.
James Stodart, Esq., M.L.A.
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L. F. Schoenheimer, Esq., J.P.
Ald. John Crase, J.P.

LIST OF MEMBERS.

P) Members who have contributed papers which are published in the Society's "Proceedings and Transactions." The numerals indicate the number of such contributions.

PP) Past President.

A dagger (†) prefixed to a name indicates a member of the Council.

Life members are distinguished thus (*).

Should any error or omission be found in this ist, it is requested that notice thereof be given to the Hon. Secretary.

Foundation Members:

P1 Atkinson, J. R., J.P., F.R.G.S.A.Q., Lic. Surveyor, Ipswich, Queensland.

Marks, Hon. C. F., M.D., M.L.C., F.R.G.S.A.Q., Wickham Terrace, Brisbane.

P1*Moor, T. B., F.R.G.S., F.R.S.Tas., Strahan, West Coast, Tasmania.

P1†Muir, A., J.P., F.R.G.S.A.Q., 354 Queen Street, Brisbane.

P35PP*Thomson, J. P., LL.D., Hon.F.R.S.G.S., etc., Hon. Secretary and Treasurer, Wood Street, South Brisbane.

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Alford, Henry King, J.P., "St. Audries," Toowoomba, Queensland.

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*Barrett, Mrs. Walter, Eagle Junction, Brisbane.

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O'Reilly, Charles, Dornoch Terrace, South Brisbane.
O'Shea, Miss E., "Middenbury," Toowong, Brisbane.
Paine, A. A., J.P., Brandon, via Townsville, Queensland.
*Parker, Francis, J.P., St. Albans, via Monkira, Queensland.
Parker, William Richard L.D.S., Eng., Rothwell Chambers, Edward Street, Brisbane.
Parr, Mrs. B. C., "Mai Gunyah," Warwick, Queensland.

Parr-Smith, Mrs. A., "Underly," Edmonstone Street, South Brisbane.
P3 Phillips, George, C.E., Telegraph Chambers, Queen Street, Brisbane.
*Plant, Major C. F., F.R.A.S., "Ferndale," Ashgrove, near Brisbane.

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1907-1908.

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VOL. XXIII.

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THE VICTORIAN EXPLORING EXPEDITION, 1860-1.*

Prepared from Official Documents and Reports.

By G. PHILLIPS, C.E.

The extraordinary misfortunes that attended the ill-fated expedition, which left Melbourne overland for the Gulf of Carpentaria on the 20th August, 1860, under the leadership of Robert O'Hara Burke, did far more to stimulate Australian Exploration than if the party —which successfully crossed the continent from south to north— had returned in triumph to Melbourne.

The Colony of Victoria did not at that time possess any eminent explorers from whose ranks a competent and experienced leader for the proposed expedition might have been chosen. The colony was small by comparison with the other colonies of Australia. The most distant part was only 350 miles from Melbourne (about the same distance as from Brisbane to Rockhampton), so that the need for explorers of the type of Eyre, Leichhardt, Gregory, Sturt, McDouall Stuart, John McKinlay, or William Landsborough, did not exist.

I have carefully studied all the available official documents and the evidence taken by the Burke and Wills Commission appointed by Sir Henry Barkly, K.C.B., Governor of Victoria, to enquire into and report upon the circumstances connected with the sufferings and death of Robert O'Hara Burke and William John Wills, the Victorian explorers, but I have found nothing to indicate the reasons that induced the Exploration Committee to select as leader Robert O'Hara Burke.

It is well known that Burke—who at that time was about 40 years of age—had seen military service in Austria, had experienced the discipline and training of the Irish Mounted Constabulary, and, at the time of his selection for the leadership of the Victorian Exploring

* Read before the Royal Geographical Society of Australasia, Queensland, November 25th, 1907.

Expedition, was an Inspector of Mounted Police at Castlemaine, Victoria.

Whatever qualifications Burke may have had as a leader of men, and doubtless he had many good qualities to recommend him, he evidently lacked the essential faculties of organisation and foresight, nor had he the advantage of that personal knowledge and experience of frontier life in the bush without which no man could reasonably expect to succeed as an Australian explorer.

Mr. Ernest Favenc, himself no mean exponent of the art, in his "History of Australian Exploration," says :—" Of special aptitude or scientific training Burke possessed no pretension, and his selection was a fatal blunder. In saying this," adds Mr. Favenc, " there is no reflection on the private character of the mistaken leader ; he paid for the wrong estimation he held of his own fitness with his life, and the fault rests with those who placed him in a position where he also was responsible for the lives of others."

Burke's party was far too large and unweildy at the commencement and much too scantily equipped when, greatly reduced in numbers, it made its final gallant, but ill considered dash for the North.

Burke staked his life and the lives of his three companions, as well as the success of the expedition, upon the fidelity, intelligence, experience, and steadfastness of two young men, Brahé and Wright, neither of whom were officers selected by the Exploration Committee. They had been provisionally appointed by Burke during the march from the Darling River to Cooper's Creek, as officers in charge of the depots on Cooper's Creek and the Darling River respectively. Burke formed a high, but exaggerated opinion of Wright, because he had successfully guided him for 200 miles from Menindie, on the Darling River, to Torowotto, over country with which Wright was familiar as the manager of Menindie Station—but he had never been on Cooper's Creek ; had no experience as an explorer or surveyor, and had no special qualification as a leader beyond the fact that he appears to have been a fairly good bushman. Brahé, on the other hand, by his fidelity to the onerous trust reposed in him by Burke, and the capable manner in which he kept his little party together at Cooper's Creek for a period of 4 months and five days, and finally by successfully conducting the retreat of the party under his command towards the Darling River—under very trying and difficult circumstances—proved his capacity and fitness for the responsible post in which he was placed.

The party originally comprised—besides the leader—G. J. Landells, as second in command ; William John Wills, a land surveyor and expert astronomical and meteorological observer, as third officer ; Dr. Hermann Beckler, medical officer and botanist ; Dr. Ludwig

Becker, artist, naturalist, and geologist; ten white men and three Afghan or Indian camel drivers—in all eighteen men with a great convoy of horses, camels, and stores of every description.

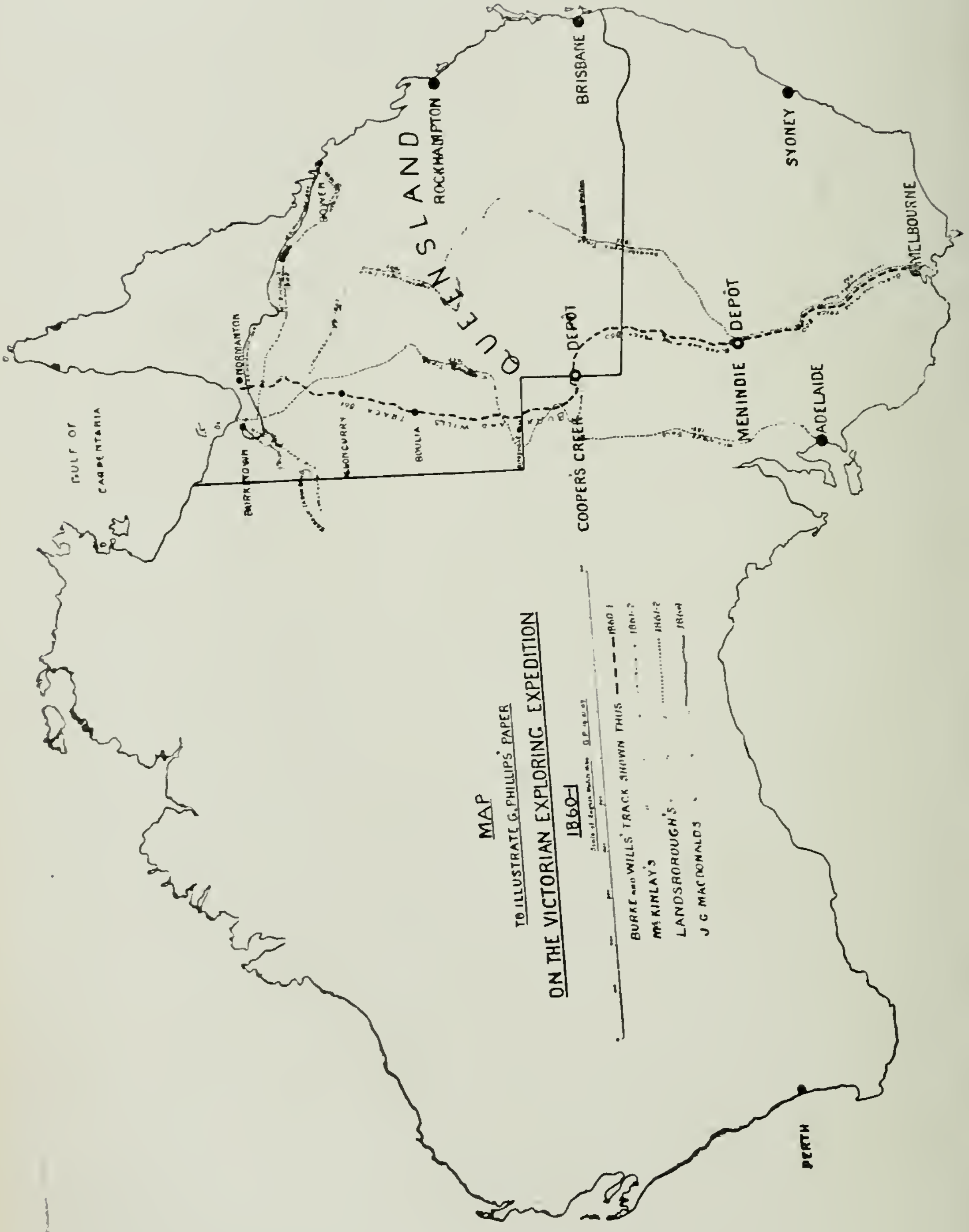
The total value of the equipment, including riding and pack animals, is officially given as £4,585, whilst no less than £12,000 was provided, partly by the Government, and partly by public subscription, to meet the expenses of the expedition.

It was no part of the arrangements made by the Exploration Committee for a vessel to meet Burke at Carpentaria, and it was thoroughly understood that Burke would have to return to the settled districts relying upon his own resources and in the best way he could. In fact the committee contemplated a much more comprehensive and extensive scheme of exploration, over a much wider range of country, than that actually attempted by Burke, nor did the committee contemplate the splitting up of the party to the extent adopted by the leader.

Although much was indicated in the instructions of the committee as things desirable to be done or attempted, the committee wisely intrusted the leader with the largest discretion as regarded the forming of depots and his movements generally, but they particularly requested that he would mark his route as permanently as possible by leaving records, sowing seeds, building cairns, and marking trees at as many points as possible, consistent with his various other duties. These instructions received so little attention that it is not certainly known at what point they actually reached tidal water on the Gulf of Carpentaria. According to King, the only survivor of the four men who crossed the continent, Wills, the surveyor, thought they were on the Albert River, whereas Baron von Mueller, from a careful study of Wills' observations and notes, was confident that they were on the Flinders River—the two rivers being more than 70 miles apart.

King stated in his evidence in answer to question No. 862 that at camp No. 119, which was situated on the eastern bank of a tidal river, marks were made on some fifteen small box trees, by strippin the bark 18in. x 4in., and cutting the letter B in the trees.

It is at least possible if a careful search were made even after the lapse of 46 years that these marked trees might be found and verified, and I think it would be to the credit of this State if an effort were made to find these interesting relics of the Burke and Wills expedition, so that we might certainly know the exact spot where the explorers reached tidal water after their march from Cooper's Creek, and the place from whence—having accomplished their purpose, they retraced their steps towards home.


GULF OF CARPENTARIA
BURKETOWN
NORMANTON
CLONCURRY
BOULIA
QUEENSLAND
BOWEN
ROCKHAMPTON
BRISBANE
DEPÔT
COOPER'S CREEK
MENINDIE
DEPÔT
SYDNEY
ADELAIDE
MELBOURNE
PERTH
MAP
TO ILLUSTRATE G. PHILLIPS' PAPER
ON THE VICTORIAN EXPLORING EXPEDITION
1860-1
BURKE AND WILLS' TRACK SHOWN THUS
M^cKINLAY'S
LANDSBOROUGH'S
J G MACDONALDS

The Expedition.

The party had not left the settled districts before Landells (who had brought the camels from India, and who, on account of his special knowledge of the working of camels, had been appointed second in command) resigned in consequence of a quarrel with the leader. Wills thus became second, and Mr. William Wright (a station manager at Menindie, on the Darling River, who volunteered to guide the party thence to Torowotto, about 200 miles) was subsequently appointed by Burke as third officer, to have charge of that section of the party that remained at the depot at Menindie, on the Darling River, and to keep open the line of communication between that depot and the depot on Cooper's Creek.

As matters subsequently developed the appointment of Wright to a position of great responsibility proved an unfortunate one, but from a careful perusal of the evidence taken by the commission appointed to ascertain the true causes of the lamentable result of the expedition, I cannot but attribute much of the failure primarily to the absence of detailed and well considered written instructions from Burke to the officers he left behind him for the purpose of protecting his rear and to maintain depots on which he might successively fall back on his return journey from Carpentaria to the Darling River.

Neither Brahé, who was left in charge of the depot on Cooper's Creek, or Wright, had any but verbal and somewhat vague instructions from Burke as to what they were to do during his absence, or in what manner they were to co-operate with one another. On the 29th October, 1860, Burke reported to the committee, from Torowotto, that he left Menindie on the 19th idem with ten men, exclusive of the leader, 18 horses, and 16 camels. Mr. Wright, who had volunteered to accompany Burke as guide, was sent back to Menindie to bring the remainder of the camels and a supply of jerked beef to Cooper's Creek. Unfortunately, Burke appointed Wright as third officer subject to the approval of the exploration committee sitting in Melbourne, and he expressed the hope that they would confirm the appointment. This caused serious, in fact fatal delay, for Wright hesitated to act until his appointment was confirmed, and in any case he lacked means to purchase the horses he required to give effect to Burke's instructions. Finally Wright despatched Mr. W. O. Hodgkinson, a member of his party, to Melbourne, to interview the committee and procure money for the purchase of horses. Hodgkinson was supplied with £400, and left Melbourne on the 2nd January, 1861. On the 26th idem Wright having secured the necessary horses, commenced his advance from Menindie towards Cooper's Creek

with an ample supply of provisions and stores, which in the sequel it will be seen, never reached Cooper's Creek.

On the 13th December, 1860, Burke reported from Cooper's Creek that on the morrow he would start with three men (Wills, King, and Gray), six camels and one horse for Eyre's Creek (which drains the country to the west of the Diamantina River), and from thence he would endeavour to explore the country to the north in the direction of Carpentaria, and he added : "It is my intention to return here within the next three months at latest." This was the last report received from Burke who kept no memoranda of the journey to or from Carpentaria, so that what is known of the movements of the party after it left Cooper's Creek has been obtained from such of Wills' journals as were saved or found, and the evidence of the survivor, John King.

Mr. William Brahé was left in charge of the depot at Cooper's Creek. He had with him two white men, Mc Donough and Patten, and Dost Mahommed, one of the Indian camel drivers. Brahé had no written instructions from Burke, but in his evidence he stated that he was verbally instructed to remain at the depot three months, or longer, if provisions and other circumstances would permit, whilst from day to day he expected to be relieved by Wright, who was third officer. Burke and his three companions actually left Cooper's Creek on their final dash for the Gulf of Carpentaria, at 6.40 a.m. on the 16th December, 1860.

Brahé remained at his post for four months and five days during which he had no communication with Burke on the one hand or Wright on the other. He experienced much trouble owing to horses and camels straying and the frequent and annoying visits of blacks. His two white men fell sick, one almost to death from scurvy, and the other suffered from the kick of a camel. His supplies of food, also, were getting somewhat scanty, and in any case not suitable for those who were sick. He had no means of knowing how near or how far Burke might be or when he might expect relief by the arrival of Wright. Finally yielding to the urgent request of the dying man, Patten, and with the consent of the othert members of his party, he deemed it advisable to leave Cooper's Creek depot, which he did at 10 a.m. on Sunday, the 21st April, 1861, and, after burying in a cache all the stores he could spare, he retreated in good order in the direction of the Darling River. On the 29th April, after his horses had been 100 hours without water, he fell in with Wright, who with his Menindie party was making what appears to have been a determined effort to reach the depot on Cooper's Creek. Brahé's responsibility ceased as soon as he came under Wright's orders, but unfortunately Wright

had had a great deal of sickness to contend with—although he had two medical men in his party, and he had actually buried two men (Stone and Purcell) a short time before, whilst on the afternoon of the day that Brahé joined, Dr. Becker, another member of Wright's party, died.

On the 3rd May, Wright and Brahé, with three horses and only sufficient provisions for their own use, made an excursion to the Cooper's Creek depot, which they reached on the morning of the 8th May, but they found no visible evidence that Burke had visited it since Brahé left on the morning of the 21st April. So satisfied was Brahe that everything about the old depot camp on Cooper's Creek was precisely as he had left it 17 days before that he did not open the cache in which he had buried provisions for Burke's use in the event of his return. Had Brahé opened the cache he must have discovered that Burke, Wills, and King had returned to the depot on the evening of the day he (Brahé) had left for the Darling. Unquestionably, Wright, who at that time was in full charge of the rear guard, made two fatal mistakes. (a) he should have carried back a further supply of provisions and clothing for Burke, and (b) he should have opened the cache. If he had done these two necessary and obvious things, both Burke and Wills, as well as King, must have been saved.

Wright and Brahé, after the very superficial inspection of the depot camp that I have described, and without leaving anything to indicate that they had revisited the place, at once retraced their steps and rejoined the main party on the 13th May. This excursion on the part of the two responsible depot officers occupied a period of ten days, during which they traversed, and retraversed, with only three horses, one of the dryest pieces of country in Australia. It was a great and courageous efforts and deserved more success, but it absolutely and completely failed for the want of the few minutes extra exertion required to open the old cache, which, if they had done, they would have known that the lost explorers had returned to the depot on the day that Brahé left it, and that they were greatly in need of assistance.

Patten, whose serious illness had weighed with Brahé in arriving at his decision to abandon the depot on Cooper's Creek, died on the 5th June, making the fourth man buried by Wright since leaving Menindie on the 26th of the previous January.

In passing I may mention as a matter of special interest to Queenslanders that the late Honourable W. O. Hodgkinson, who was Minister for Mines in this State, 1890-1893, was a very useful and energetic member of Wright's party, and he accompanied McKinlay throughout the whole of his relief expedition from Adelaide to Carpentaria and thence to Bowen.

The Dash for the Gulf.

As already mentioned, Burke, Wills, King, and Gray left the Cooper's Creek depot on their final dash for the Gulf of Carpentaria at 6.40 a.m. on the 16th December, 1860, taking with them six camels, one horse, and provisions estimated to last three months. These gallant men vigorously prosecuted their journey northward on foot. Their course lay generally between the 139th and the 141st meridians. The distance as the crow flies from the Cooper's Creek depot to the point at which they found tidal water from the Gulf of Carpentaria is 680 miles. Allowing only ten per cent. additional for unavoidable detours, the journey which they undertook to accomplish chiefly on foot through an unknown and trackless region before they could expect to return to the depot on Cooper's Creek, was 1,500 miles, but it is probable that they actually traversed a great deal more than that.

Their route carried them past the present position of the town of Boulia and through what is now known as the Cloncurry district. Wills in his journal under date 19th January, 1861, says : " After crossing the creek, we took a due north course over very rugged quartz ranges of an auriferous character. Pieces of iron ore, very rich, were scattered in great numbers over some of the hills."

As this description is characteristic of the neighbourhood, I have but little doubt that the explorers passed within sight of the ground now occupied by the town of Cloncurry.

On the 27th January Wills thus describes the river (which Burke named in honor of his friend Lord Cloncurry) down which they had been travelling for some ten days in a northerly direction :—" We followed along the bends of the creek by moonlight, and found the creek wind about very much, taking on the whole a north-east course. At about five miles it changed somewhat its features, from a broad and sandy channel, winding about through gum tree flats, it assumes the unpropitious appearance of a straight, narrow creek, running in a north-north-east direction between high, perpendicular, earthy banks." This latter description is characteristic of the channel of the Cloncurry River in the neighbourhood of Sedan, in latitude 20 deg.

On the 11th February, 1861, they reached tidal water. According to King, the explorers thought they were on the eastern or right bank of the Albert River, thus showing that Wills regarded the Cloncurry as a tributary of the Albert, instead, as it actually is, a branch of the Flinders River. At that time, however, nothing was known of the course of the rivers flowing into the southern end of the Gulf of Carpentaria. Leichhardt in 1845, and Gregory in 1856, had each skirted the southern end of the Gulf, whilst in 1848, Stokes of the Beagle had surveyed the estuary of the Albert and a few miles of the

lower Flinders, besides giving names to the mouths of the Bynoe River, Accident, Disaster, and Morning Inlets, and the "Plains of Promise," some 20 miles south of the present Burketown.

No doubt the explorers followed the Cloncurry downwards to its confluence with the Flinders, and from thence they followed the Flinders—probably on its eastern or right bank—to some point on the Bynoe, which forms the eastern channel of the delta of the Flinders, so that most probably the explorers reached tidal water at a point about 24 miles south-west from the town of Normanton, which, of course had no existence at that time, although it was founded six years later. Dr. Ferdinand von Mueller, who accompanied A. C. Gregory in his expedition from the Victoria River to Brisbane in 1855-6, and who, had crossed all the rivers flowing into the southern end of the Gulf, was firmly of opinion from a careful examination of all the available data left by Wills, that Burke reached tidal water on the Flinders and not on the Albert River. Wills' description of the country near the sea more nearly corresponds with the country on the right or eastern bank of the Bynoe than that on the Albert River, and from my personal knowledge of the country between Burketown and Normanton I have no doubt that when Burke decided that he had gone as far North as he could penetrate and must retrace his steps to Cooper's Creek, he was on the right bank of the Bynoe River.

The Return Journey.

They started on their return journey in good spirits on the 13th February, 1861, rather less than two months from the time they left the depot on Cooper's Creek. As they carried no tents they suffered a good deal from exposure to the heavy wet season whilst in the vicinity of the Gulf, and their progress was greatly retarded by the soft and boggy nature of the country. Some idea of the inconveniences to which they were subject may be gathered from the following extract from Wills' journal: "Saturday, 23rd February, 1861, camp 8R. In spite of the difficulties thrown in our way by last night's storm we crossed the creek, but were shortly afterwards compelled to halt for the day on a small patch of comparatively dry ground, near the river. The day turned out very fine, so that the soil dried rapidly, and we started in the evening to try a trip by moonlight. We were very fortunate in finding sound ground along a billabong, which permitted of our travelling for about five miles up the creek, when we camped for the night. The evening was most oppressively hot and sultry, so much so that the slightest exertion made one feel as if he were in a state of suffocation. The dampness of the atmosphere prevented any evaporation, and gave me a helpless feeling of lassitude that I have never be

fore experienced to such an extent. All the party complained of the same symptoms, and the horse showed distinctly the effect of the evening trip, short as it was. We had scarcely turned in half an hour when it began to rain." This is one of the very few notes of complaint to be found in Wills' journal.

On the 3rd March they killed a tiger snake 8ft. 4 in. in length and 7 in. in girth. They seem to have partaken of the reptile, for on the 5th March Wills says : " Mr. Burke felt very unwell, having been attacked by dysentery since eating the snake."

On the 7th March : " Mr. Burke almost recovered, but Charley (Gray) is again very unwell and unfit to do anything; he caught cold last night through carelessness in covering himself."

On the 25th March, Wills made the following entry in his journal : " After breakfast took some time altitudes, and was about to go back to last camp for some things that had been left, when I found Gray behind a tree eating skilligalee. He explained that he was suffering from dysentery, and had taken the flour without leave. Sent him to report himself to Mr. Burke, and went on. He, having got King to tell Mr. Burke for him, was called up, and received a good thrashing. There is no knowing to what extent he has been robbing us. Many things have been found to run unaccountably short." Wills was not present when Burke punished Gray. King in his evidence said that Wills was mistaken in saying that Burke gave Gray a good thrashing, and that Burke merely gave Gray several, perhaps six or seven boxes on the ear with his open hand.

Subsequently Gray became seriously ill and died on the 16th or 17th April within about 15 miles of Cooper's Creek, and by the Creek about 70 miles from the depot. As they lost a day in attending to and burying Gray, the delay, unavoidable as it was, probably cost Burke and Wills their lives.

The three survivors with only two camels, and they in a very weak condition, reached the depot on Cooper's Creek at 7.30 p.m. on Sunday the 21st April, 1861, just 9½ hours after Brahé had commenced his retreat to the Darling.

In answer to question No. 1010 : " When you arrived at the depot what observations or conversation took place ? " John King replied : " When we arrived at the depot Mr. Burke was a little ahead of Mr. Wills and myself. He had often said, ' I think I see their tents ahead ' ; he made several remarks like that till we arrived there, when he cooed several times out the names of the men (Brahé, McDonough, and Patten). Then he said, ' I suppose they have shifted to some other part of the Creek.' Mr. Wills also thought they had shifted for better feed to some other part of the creek. Mr. Wills was the first

who saw the tree marked, and saw the horse or camels' dung and the things scattered about the stockade, and we knew then that if they had shifted to any other part they would have taken the things with them there. Then Mr. Wills saw the mark on the tree, " dig three feet north west or north-east,' I am not sure which, and the date they left the depot was the same date as we arrived. Mr. Wills said, " they have left here to-day.' He said, ' if they had shifted to any other part of the creek they would not have marked that.' "

They dug up the provisions left by Brahé, but in their exhausted condition it was quite impossible for them to overtake the depot party, although they were camped only 14 miles away that night.

The abandoned explorers after resting two days and recruiting their strength with the better food, made several fruitless attempts to retreat in the direction of Mount Hopeless, in South Australia, but were always baffled by the long and waterless stages, so that finally they wandered hither and thither in a more or less aimless manner depending chiefly upon the kindness of the blacks for food.

Even at this stage, when hope must almost have deserted them, Wills, who was the only scribe, but seldom touched a note of despair or sadness in his journals. On the 6th May, I find the following entry: " Moved up the creek again to camp No. 9, at the junction, to breakfast, and remained the day there. The present state of things is not calculated to raise our spirits much ; the rations are rapidly diminishing ; our clothing, especially the boots, are all going to pieces, and we have not the materials for repairing them properly ; the camel (the only one left) is completely done up, and can scarcely get along, although he has the best of feed and is resting half his time. I suppose this will end in our having to live like the blacks for a few months." After the above entry they made another ineffectual effort to cross the dry country in the direction of Mt. Hopeless, but, as before, were compelled to return to Cooper's Creek.

On the 27th May, Burke sent Wills alone to revisit the depot on Cooper's Creek in order to deposit journals and a record of the state of affairs. He had not gone far when he was overtaken by about twenty blacks, who were bent on taking him back to their camp, and promised any quantity of nardoo and fish. " On my going with them," says Wills, " one carried the shovel, and another insisted on taking my swag in such a friendly manner that I could not refuse them. They were greatly amused with the various little things I had with me. In the evening they supplied me with abundance of nardoo and fish, and one of the old men, Poko Tinnamira, shared his gunyah with me." I have quoted the extract in full in order to show the exceedingly friendly relations that existed between the blacks

and the unfortunate explorers. These good relations were maintained unimpaired right up to the time, when, on the 15th September, 1861, King, the only survivor, was rescued by Howitt's party.

Wills reached the old depot camp on the fourth day after leaving his comrades. I find the following entry in his journal of the 30th May: "Reached the depot this morning at 11 a.m. No traces of any one except blacks having been here since we left. Deposited some journals and a notice of our present condition. Started back in the afternoon and camped at the first waterhole."

With the assistance of the blacks, who displayed great kindness, Wills was enabled, though his strength was fast failing, to return to Burke and King on the 6th June, after a journey of eleven days, entirely at the mercy of the blacks and depending chiefly upon them for food. This journey completely exhausted Wills, who never again recovered his strength.

The journal of this truly brave man who was only 27 years of age, contains but little by way of complaint and he was cheerful to the last. I cannot refrain from giving a few brief extracts to show the straits to which they were reduced and how well they kept together and helped one another.

7th June.—Started in the afternoon for the black's camp, found ourselves all very weak. I myself could scarcely get along, although carrying the lightest swag, only about 30 lbs.

8th June.—With the greatest fatigue and difficulty we reached the nardoo camp.

9th June.—King and I proceeded to collect nardoo, leaving Mr. Burke at home.

10th June.—Mr. Burke and King collecting nardoo, self at home too weak to go out, was fortunate enough to shoot a crow.

11th June.—King out for Nardoo. Mr. Burke up the creek to look for the blacks.

12th June.—King out collecting nardoo. Mr. Burke and I at home pounding and cleaning.

13th June.—Mr. Burke and King out for nardoo, self weaker than ever, scarcely able to go to the waterhole for water.

14th June.—King out for nardoo, brought in a good supply, Mr. Burke and I at home pounding and cleaning seed. I feel weaker than ever, and both Mr. B. and King are beginning to feel very unsteady in the legs.

15th June.—King out for nardoo, brought in a fine supply, Mr. Burke and I pounding and cleaning; he finds himself getting very weak, and I am not a bit stronger. I have determined on beginning to chew tobacco and eat less nardoo, in hopes that it may induce some

change in the system. I have never yet recovered from the effects of the constipation, and the passage of the stools is always exceedingly painful.

16*th June.*—We finished up the remains of "Rajah" (the last camel) yesterday for dinner. King was fortunate enough to shoot a crow this morning.

17*th June.*—Night very boisterous and stormy; heavy showers of rain, &c. (Remember these poor fellows had no tents or efficient shelter.)

18*th June.*—Exceedingly cold night.

20*th June.*—I am completely reduced by the effects of the cold and starvation. King out for nardoo; Mr. Burke at home pounding seed, he finds himself getting very weak in the legs. King holds out by far the best, the food seems to agree with him pretty well.

21*th June.*—I feel much weaker, and can scarcely crawl out of the mia-mia; unless relief comes in some form or other I cannot possibly last more than a fortnight (And then follows the only note of complaint to be found in Wills' journals.) It is a great consolation at least in this position of ours to know that we have done all we could, and that our deaths will rather be the result of the mismanagement of others than of any rash acts of our own; had we come to grief elsewhere we could only have blamed ourselves; but here we are returned to Cooper's Creek, where we had every reason to look for provisions and clothing, and yet we have to die of starvation in spite of the explicit instructions given by Mr. Burke—'That the depot party should await our return, and the strong recommendation to the committee that we should be followed up by a party from Menindie.'

22*nd June.*—Mr. Burke and King out for nardoo, the former returned much fatigued. I am so weak to-day as to be unable to get on my feet.

23*rd June.*—I am so weak as to be incapable of crawling out of the mia-mia. King holds out well, but Mr. Burke finds himself weaker every day.

24*th June.*—A fearful night. At about an hour before sunset, a southerly gale sprung up and continued throughout the greater portion of the night; the cold was intense, and it seemed as if one would be shrivelled up. King went out for nardoo in spite of the wind, and came in with a good load, but he himself terribly cut up. He says that he can no longer keep up the work, and as he and Mr. Burke are both getting rapidly weaker, we have but a slight chance of anything but starvation unless we can get hold of some blacks.

25*th June.*—The cold plays havoc with us from the small amount of clothing we have. My wardrobe consists of a wide awake, a merino

shirt, a regatta shirt without sleeves, the remains of a pair of flannel trousers, two pairs of socks in rags, and a waistcoat of which I have managed to keep the pockets together. The others are no better off. Besides these we have between us for bedding two small camel pads, some horse hair, two or three little bits of rag, and pieces of oil-cloth saved from the fire.

26*th June.*—Mr. Burke and King are preparing to go up the creek in search of the blacks. They will leave me some nardoo, wood, and water, with which I must do the best I can until they return. They have both shown great hesitation and reluctance with regard to leaving me and have repeatedly desired my candid opinion in the matter. I could only repeat, however, that I considered it our only chance, for I could not last long on the nardoo, even if a supply could be kept up.

I now come to Wills' final entry made on Friday, 28 June, 1861, which I transcribe in full :—" Clear cold night, slight breeze from the east, day beautifully warm and pleasant. Mr. Burke suffers greatly from the cold and is getting extremely weak ; he and King start to-morrow up the creek to look for the blacks, it is the only chance we have of being saved from starvation. I am weaker than ever, although I have a good appetite and relish the nardoo much, but it seems to give us no nutriment, and the birds here are so shy as not to be got at. Even if we got a good supply of fish, I doubt whether we could do much work on them and the nardoo alone ; nothing but the greatest good luck can now save any of us, and as for myself I may live four or five days if the weather continues warm. My pulse is at forty-eight and very weak, and my legs and arms are nearly skin and bone. I can only look out like Mr. Micawber, ' for something to turn up,' but starvation on nardoo is by no means very unpleasant, but for the weakness one feels, and the utter inability to move one's self, for as far as appetite is concerned, it gives me the greatest satisfaction, certainly fat and sugar would be more to one's taste, in fact those seem to me to be the great stand-by for one in this extraordinary continent, not that I mean to depreciate the farinaceous food, but the want of sugar and fat in all substances obtainable here is so great that they become almost valueless to us as articles of food, without the addition of something else."

This final entry is signed W. J. Wills, and is the last we see of him in life, for when King returned in a few days—having in the meantime witnessed the death of Burke—he found Wills lying dead just where they had left him.

Burke died from exhaustion on the morning of the third day, after leaving Wills, his last words to King were : " I hope you will

remain with me here till I am quite dead, it is a comfort to know that some one is by; but when I am dying it is my wish that you should place the pistol in my right hand and that you leave me unburied as I lie." King felt very lonely after the death of the leaders. He remained with the blacks, who uniformly treated him with kindness and supplied him with food, nor did they deprive him of the few things he had with him.

On the 18th June, 1861, about twelve days before the death of Burke and Wills, Wright reached the Darling and sent in his despatches to the committee. A light party under Mr. A. W. Howitt was sent in search of the missing explorers. Howitt, accompanied by Brahé as guide, arrived at the Cooper's Creek depot on the 13th September, and on the 15th the sole survivor, John King, was found sitting in mia-mia that the blacks had made for him. He presented a melancholy appearance, wasted to a shadow, and hardly to be distinguished as a civilized being, except for the remnants of clothes on him.

Howitt found and buried the bodies of Burke and Wills, but subsequently he was commissioned to bring the remains of the explorers to Melbourne, where they received a public funeral, and a statue was erected to their memory.

In the month of November, 1861, I witnessed King's return to Melbourne. He came from Ballarat by train and landed at the railway station in the presence of a large concourse of people, who, from curiosity, had gathered to see the only survivor of the four men who first crossed the Australian continent from sea to sea. I remember that King looked pale and weak, and that he had to be assisted from the railway-carriage to a vehicle. He was a short, but compactly built man, clean shaven, save for a small and dark moustache. He had been a British soldier serving in India in the 70th regiment of the line. He accompanied Mr. G. J. Landells when he brought over the camels for the expedition.

King proved himself a faithful comrade to Burke and Wills who would have died much earlier but for King's devotion in gathering nardoo when his companions were too weak to walk.

The Victorian Government gave King a pension of £180 per annum until his death, on January 15th, 1872. He only attained the age of 33 years. He was not quite 22 years old, when he joined the expedition.

Of the eighteen men who formed Burke's original party, no less than seven died, namely Burke, Wills, Gray, Purcell, Stone, Patten, and Dr. Becker. Brahé and Wright, more especially the latter, have

been severely censured for not maintaining the depot on Cooper's Creek until Burke's return.

If Brahé had remained but one day longer he would have been clear. I have already explained and stated the reasons which induced him to leave the depot.

Wright, unquestionably, lingered too long on the Darling, but he was hampered in many ways as I have already explained. He should, either have resigned or advanced earlier.

The whole of the arrangements between Burke and his depot officers, Brahé and Wright, were most loose and unsatisfactory. Far too much was left to chance or to the initiative of two men separated by hundreds of miles of almost waterless country, and who, as a matter of fact, held no communication with each other from the time that Wright left Torowotto on the 29th October, 1860, until Brahé joined Wright's party on the 29th April, 1861, eight days after Burke, Wills, and King had returned from Carpentaria to Cooper's Creek.

In addition to the troubles primarily caused by want of foresight and organisation on the part of the leaders, the most extraordinary ill-fortune appeared to dog the little band of heroes who crossed the continent.

Gray's long continued illness and finally his inability to walk, greatly retarded the movements of the returning explorers, whilst his death, some four or five days before they reached the depot, caused a delay of 24 hours, but for which Burke would have reached the depot the night before Brahé left.

Brahé abandoned the depot on the morning of the day that Burke returned. Had Burke, Wills, and King remained at the depot for seventeen days, living on the stores left for their use by Brahé, they would have been rescued by Wright and Brahé on the 8th May. Had Burke left some conspicuous evidence of his having returned to the depot on the 21st April, Brahé and Wright, doubtless, would have followed him up when they revisited the depot on the 8th May.

If, when Brahé and Wright visited the depot on the 8th May, they had taken the precaution to open the cache they would have discovered that the explorers had returned. Brahé thought that everything about the old depot was exactly as he had left it only 17 days earlier and did not take the trouble to open the cache. In fact they only stayed about a quarter of an hour, nor did they leave any note or evidence of any description to show that they had revisited the depot, so that Wills, when he returned to the depot on the 30th May, found no traces that any white man had visited the camp since he Burke, and King, had left it on the 23rd April.

Had Brahé and Wright left some conspicuous notice of their having been there on the 8th May, and that they would return as soon as they had conveyed the sick men to some place of refuge, it is possible that Burke and Wills, as well as King, might have been rescued.

Probably never before or since has such an extraordinary game of cross purposes been played in the Australian bush, with such sad and disastrous consequences.

The Results of the Expedition.

The story of Burke and Wills has been a favourite one round many a camp fire in the Australian bush, and will never be forgotten so long as this continent is dominated by an English speaking race. Their names are indelibly imprinted on the map of this State, the former in the Burke River, Burketown, and Burke District, all named in honour of Robert O'Hara Burke, whilst there are two Wills' Creeks in Queensland, one a tributary of the Burke River and the other one of the chief tidal branches of the Norman River, named by me in 1867 in honour of Wills. There is also near Bedourie, King Creek, a tributary of Eyre Creek. Although the cost of the Victorian Exploring Expedition, as well as the cost of the several relief expeditions in all about £60,000, was wholly defrayed by Victoria, by far the lion's share of the benefits accrued to Queensland.

Burke crossed the southern boundary of this State in the neighbourhood of Birdsville, traced Eyre's Creek upwards to the Burke River and from thence via the Cloncurry and Flinders Rivers to the Gulf, so that out of the ten degrees of latitude he traversed in his journey from Cooper's Creek to the Gulf, rather more than eight degrees are comprised within the boundaries of Queensland.

No sooner did Wright's despatches, reporting the non-arrival of Burke and party, reach Melbourne, than steps were at once taken to send out relief expeditions in various directions.

As already stated A. W. Howitt was sent from Menindie to Cooper's Creek with a light party, and he succeeded in finding and rescuing King on the 15th September.

On the 16th August, 1861, John McKinlay, leader of "The South Australian Burke Relief Expedition," started from Adelaide with camels, and a small flock of sheep, which he actually drove right across the continent to the Gulf of Carpentaria.

On the 20th October he discovered the grave of a white man, which is generally supposed to have been that of Gray. McKinlay prosecuted his journey northwards, via the Mueller (as he named the lower Diamantina River) as far as the junction of the Middleton River, which he followed upwards to the Gulf Watershed. Thence he followed

the McKinlay River downwards for some distance, but striking away towards the north-west he reached tidal water, between the Albert and Leichhardt Rivers, on the 12 May, 1862. From thence he followed Leichhardt's and Gregory's route towards the east and reached the east coast at Bowen early in August, 1862.

On the 25th August, 1861, a further relief expedition, under the leadership of the late William Landsborough, left Brisbane by sea for the Gulf of Carpentaria. After many vicissitudes, including the wreck of the "Firefly," brig, which conveyed Landsborough and his horses, the Gulf was reached and a landing effected at the Albert River, close to the site of the present Burketown, on the 14th October, 1861.

On the 16th November, Landsborough started in a south-westerly direction towards Central Mount Stuart. This excursion occupied him until the end of January, in the course of which he discovered and named the Gregory and O'Shanassy Rivers, and the Barkly Tableland.

On the 10th February, 1862, Landsborough finally left the Albert River and striking easterly to the Flinders, followed that river upwards past Fort Bowen and Mounts Browne and Little, which he named, until he reached the neighbourhood of the present town of Hughenden, where he left the Flinders and crossing the Great Dividing Range, struck the head of Towerhill Creek, a tributary of the Thomson River, which latter he followed downwards to the neighbourhood of Stonehenge. Here he left the Thomson and struck across to the Barcoo River, which he followed upwards for some distance and then crossed to the Warrego River in the course of which he was seventy-two hours without water. On the 21st May, 1862, he reached Messrs. Williams' station on the Warrego. Here, of course, the exploration ended, but Landsborough pursued his journey via the Warrego and Darling Rivers to Menindie and thence to Melbourne, where he had a great reception.

Either of the two relief expeditions, led respectively by John McKinlay and William Landsborough, is worthy of more detailed notice than I have found it possible to give at the fag end of this paper. Perhaps at some future time I may be permitted to return to the subject.

It now only remains to follow the fourth Burke Relief Expedition, which started from Rockhampton, under the leadership of Frederick Walker, a good bushman and an experienced officer of Native Police—in fact he was accompanied by a party of native troopers on this occasion. From Rockhampton, Walker went westerly to the Barcoo, and thence north-westerly to the Alice and Thomson Rivers. He followed up the latter and crossed the head of the Flinders, which he named

the Barkly. Thence he followed a north westerly-course until getting near the Gulf he found traces of Burke on the right or eastern bank of the Flinders River, thus confirming Baron von Meuller's opinion that Burke had reached tidal water on the Flinders and not on the Albert River. From the Flinders Walker proceeded to the Albert River, where, in accordance with his instructions, he received further supplies from Captain Norman, in charge of the colonial warship "Victoria," who had escorted Landsborough to the Gulf. Walker then returned to the Flinders with the intention of following Burke's tracks where-ever they might lead, but found it impossible to do so, owing to the lapse of time since Burke left the Gulf on his return south, a period of nearly twelve months. Walker formed the opinion that Burke had made towards the east coast whither he made his way via the head waters of the Norman and Flinders Rivers and thence via the Burdekin to Bowen, where he arrived in the early part of April, 1862. As Walker did not satisfactorily delineate his route on the map his expedition did not add much to the geographical knowledge of Queensland, but it served to prove beyond question that Burke did reach tidal water on the Gulf of Carpentaria, and that his journey northwards terminated on the Flinders, and not on the Albert River as he had supposed.

In 1866, Walker was employed by the Queensland Government to explore the country between Cardwell and the Gulf of Carpentaria, with a view to discover the best practicable route for the proposed overland telegraph line to connect with the then proposed eastern sub-marine cable. By some mismanagement this lucrative business was secured by South Australia. Walker died at a wretched bush shanty near Floraville head station on the 16 November, 1866, aged 47 years. I was camped at the Leichhardt River Falls at the time where I made the acquaintance of Mr. Walker.

The pastoral occupation of the Burke district very rapidly followed the series of expeditions I have described.

Mr. J. G. Macdonald, F.R.G.S., and an honoured member of this society, at that time the managing partner of the great pastoral firm of R. Towns and Company, of which the late Sir John Robertson was a member, led a private expedition from Port Denison (Bowen) to the Gulf of Carpentaria, in search of country suitable for pastoral occupation, or "new country," as it was then termed.

Leaving Bowen on the 11th August, 1864, accompanied by two white men and a black boy, with seventeen horses and provisions for two months, Macdonald in the short space of 44 days, reached the Gregory River in south latitude 18 deg. 50 sec. His route was via the Burdekin River to Carpentaria Downs station, and thence across

the Newcastle Range to the Robertson River, and via that river and the Gilbert to the low country skirting the southern end of the Gulf. He crossed the Norman River at the rocky bar which is now the site of the bridge on the railway from Normanton to Croydon, which it fell to my lot to construct twenty-four years later.

The Gregory was traced downwards to a few miles below its junction with the Nicholson River, where a depot was formed, the distance from Bowen by Macdonald's route being 720 miles.

From thence Mr. Macdonald marked, took up, and stocked, about one million acres, comprising the "Plains of Promise," of Captain Stokes. The site for the head station, "Floraville," was fixed a short distance above the falls of the Leichhardt River, on its left or western bank.

In May, 1865, Mr. Macdonald chartered the "Jackmel Packet," at Sydney, to carry supplies and men to form the new settlement on the Albert River. The "Jackmel Packet" was the first ship to sail the waters of the Gulf of Carpentaria for commercial purposes.

Thus in a little more than four years after Burke reached the Gulf, Burketown was founded. It was then, and still is, the most remote settlement in Queensland. Normanton was founded early in 1867. It fell to my lot to survey both those towns and to make the first surveys of the Burke district as far south as the present town of Cloncurry, the position of which I fixed in 1868 by means of a horse traverse and pocket sextant survey, to the exact second of latitude, and, relatively with Normanton, to within fifteen chains of longitude.

In a few weeks railway communication will be established between Cloncurry and the east coast at Townsville, and it may be confidently predicted that the day is not far distant when Cloncurry will enjoy uninterrupted railway communication with Rockhampton, Brisbane, Sydney, Melbourne and Adelaide.

It may be truthfully said of Robert O'Hara Burke and William John Wills, that they did not live in vain, and that by laying down their lives in the wilderness, they accomplished far more than falls to the lot of many who attain the allotted span, and who die comfortably in their beds.

HOLIDAY RAMBLES ON THE UPPER LOGAN.*

By J. P. THOMSON, LL.D., Hon. F.R.S.G.S., etc.

THE Christmas holidays of 1907 afforded the opportunity of gratifying a long-cherished wish, advantage being taken of the occasion to visit the Upper Logan district and some of the rugged borderlands. Accompanied by two of the writer's sons, James Lawrence and Norman MacGregor, the journey commenced at 2.15 p.m. on Saturday, the 21st December, from the Melbourne-street Railway Station. The weather was stormy and heavy rain fell intermittently, holding out but little hope of the favourable conditions that soon followed and continued all through the Christmas holidays. At Beaudesert we changed into the tram, and went on as far as Laravale, about 56 miles from Brisbane, and situated in one of the finest pastoral and agricultural districts in Queensland, in the midst of park-like surroundings. The country all along was looking charming, the beautiful dark green grass and other forms of vegetation silently proclaiming the abundant rainfalls of the season; and the fat stock browsing lazily on either side of the track bore eloquent testimony to the nutritious herbage so greedily cropped. The low hills, extensive valleys, and meadow-like plains, dotted here and there with lightly timbered areas combined to form a landscape of great charm and beauty, and the quaintly picturesque grass tree (*Xanthorrea*) silently proclaiming itself as one of the most remarkable forms of vegetation peculiar to the temperate zone of Australia. The Beaudesert Tram Line is quite a recent concern, being the outcome of one of those private enterprises to which the march of British Empire and industrial progress are so largely indebted, and indicating in a very striking manner the favourable conditions of local settlement. Built and maintained at the expense of the local Shire Council, this tram line goes as far as Christmas Creek and Innes Plains, carrying passengers and goods, the rail gauge being the same as the State railways, with which there is a connection at Beaudesert. In the best interests of settlement it is however necessary that the tram line should be extended to other parts of the district, including Upper Christmas Creek, so as to afford means of easy access to the high lands and salubrious spots along the Macpherson Range.

At Laravale we were met by Mr. R. M. Collins and his son, Chris, who drove us to their charming home, "Tamrookum," under whose hospitable roof we remained, as the guests of a former worthy President

*Read before The Royal Geographical Society of Australasia, Queensland, March 26th, 1908.

of the Royal Geographical Society. We rested on the following day, intending to continue the journey up Christmas Creek on Monday morning.

"Tamrookum," it may be remarked, is beautifully situated on an ideal spot formed by one of the gracefully sweeping bends of the Logan River, resembling a peninsula. Built on the lower slopes of slightly rising ground it is permanently watered by a deep crescent-shaped lagoon, fringing the foot of the ridge on which the station buildings are located. This natural storage reservoir of good potable water, teeming with delicious food fish, besides adding greatly to the attractiveness of the place, is quite "A thing of beauty and a joy for ever." In times of prolonged drought its utility as a never failing source of supply for thirsty stock cannot be too highly valued or over-estimated. Although but slightly raised above the alluvial flats of the river valley, "Tamrookum" is so ideally situated as to command a magnificent panoramic view of some of the highest peaks and summit ridges of the Macpherson Range. In point of fact the outlook from the verandah is one of unsurpassed grandeur, comprising a beautiful aspect of Mt. Barney and Mt. Lindesay, the Lamington Plateau and other noted elevations stretching easterly and westerly along the border, where great cloud masses accumulate and precipitate their moisture from time to time, on the steep slopes and deep ravines. According to arrangements our journey was resumed on the following morning, when we all started on horseback under ideal weather conditions. The tents, rations, and most of the baggage had preceded us by vehicular transport from "Tamrookum," the balance of our impedimenta accompanying us on pack horse in charge of Mr. Tully, who acted as a very efficient escort. We had provided ourselves with a handy camera and adequate instrumental equipment, but unfortunately one of our best and most valuable thermometers was rendered useless through an accident alongside the camp fire in the evening. The delicate mercury tube having been left on the grass for a little while without its protective cover, for the purpose of recording the surface temperature after sun down, was found to be fractured and useless. After a long and rather hot ride up the valley of Upper Christmas Creek, we arrived at Mr. Walshe's homestead, near the foot of the Lamington Plateau, and pitched camp for the night on the left bank of a beautiful stream of cool, crystal-like running water. The sky was clear and heavy dew fell after sunset, this being accompanied by a considerable fall of temperature. Early on the following morning we were joined by Mr. J. T. Buchanan, the hardy and genial pioneer of Christmas Creek, who accompanied us on a preliminary examination of the slopes of the Plateau. On returning to the foot of the range we proceeded up the Creek

TAMROOKUM HOMESTEAD.

(From the "Queenslander.")

LOGAN RIVER AT TABOOBA

(From the "Queenslander.")

for about a couple of miles, and stopped at Mr. Buchanan's homestead, where we met with every attention and kindness. This was now Christmas Eve, and on the following morning the party was divided for field operations. My second son, James Lawrence, accompanied by Messrs. Buchanan and Tully, climbed to the top of the Plateau, made a series of valuable barometric and temperature observations, secured several interesting botanical specimens, and returned late in the afternoon. At the same time the other members of the party, comprising the writer and his youngest son, Norman, were exploring the country higher up the valley, about the head of the Creek. And here let me make some brief observations on the general geographical conditions of the surrounding district. The Logan River and tributory streams drain an area of some 1,480 square miles of fertile country, lying south of the metropolis, and comprising one of the most picturesque and salubrious districts in the State, if not in the whole of the Commonwealth. On the east it is partly bounded by the Darlington Range, on the extreme south by the Macpherson Range, dividing New South Wales from Queensland, and on the west by a moderately high range, culminating in Mt. Moon, Mt. Alford, Mt. French, and Flinders Peak. Geographically considered it is one of the most interesting catchments of the whole of the State, comprising as it does the highest crest-line of the border range, extending from Mt. Merino on the east to Wilson's Peak in the extreme west, where it is separated from the head waters of the Condamine River by a short and narrow connecting ridge. Orographically the range, although steep, rugged and precipitous on the northern profile is not so severely sculptured as on the New South Wales side, where a vertical wall of rock in some places proclaims its inaccessibility and warns man against the folly of intrusion within its virgin solitude. Stretching easterly and westerly along the southern horizon the lofty culminating peaks and summit ridges of the range may be easily seen in clear weather from Highgate Hill, Paddington heights, Gregory Terrace, Dornoch Terrace, and other metropolitan elevations. The most noticeable features standing out against the sky line in majestic isolation are the rugged summit peaks of Mt. Barney and the singularly sculptured outlines of Mt. Lindesay, the latter being the most distinctive orographical feature in southern Queensland, and one whose topographical outlines have no counterpart anywhere else in Australia. In general appearance it bears a not too remote resemblance to a crown pumpkin or a huge pudding mould, with cone shaped head, rising over sharply defined shoulders, and varying but little in bold outline and general configuration when viewed from every point of the compass. Just as to how it became possessed of its present name is a matter which

CATTLE FEEDING—AIREDALE.

(From the "Queenslander.")

LUNCH IN THE SCRUB—TAMROOKUM HOUSE PARTY.

some years ago formed the subject of an interesting paper to our Society by Mr. R. M. Collins, who showed conclusively that it was originally called Mt. Hooker by Cunningham and furthermore the mountain now known as Mt. Barney was at first named Mt. Lindesay. It is a source of regret that the original nomenclature should have been changed, so as to cause some confusion in correctly interpreting and comprehending the narratives of early exploration and discovery in the Moreton district.

The striking configuration of what is now known as Mt. Lindesay is occasioned by the sheer precipices on all sides, rising in vertical buttress from the talus slopes at the base. It is said that the mountain has been scaled once or twice by some enterprising local mountaineers, but no record of the achievement is to be found in current scientific literature, and it may therefore be assumed that the ascent was not accomplished for any useful purpose, but rather out of mere curiosity, to prove its possibility. Any way it may be fairly said that for all practical purposes the peak, although but slightly over 4,000 feet above sea-level, is not accessible, except to those provided with special scaling appliances. On the other hand its companion, Mt. Barney, although higher and partaking more of the true character of a great mountain mass, is accessible, and was climbed for the first time of which there is any record by Capt. Logan on the occasion of his visit to the locality in 1828.

From the head of the Logan River the Macpherson Range extends easterly to Point Danger at the extreme south-east corner of the State. Its westerly extension terminates in the Great Dividing Range that constitutes one of the dominating and most enduring physical features of Eastern Australia, extending from the southern Alps along the entire seaboard of the Continent to Cape York Peninsula. Geographically the Macpherson Range presents some features of wide interest, revealing its origin in one of those great earth folds which have given to the solid crust that rugged appearance so peculiar to the terrestrial sphere. Its strikingly sculptured topography suggests a former activity of the great plutonic forces that have operated so extensively in past ages, when the porphyritic rocks of the principal peaks were developed and the associated strata were tilted up at various angles. The porphyritic cappings, sometimes exceeding 2,000 feet in height, are found resting on the carbonaceous rocks of the Ipswich formation. They reveal their columnar structure on the steep, vertical sides of the peaks, which are bare and exposed, showing that the greater part of them when erupted must have been in a less fluid state than the basaltic rocks that occur on the flanks of the range. But the general physical structure of the range proper is of Devonian slates,

A CROSSING ON CHRISTMAS CREEK.
(From the "Queenslander.")

TRAMWAY BRIDGE OVER CHRISTMAS CREEK.
(From the "Queenslander.")

which have been tilted up by the eruption of the porphyry after the coal beds were deposited in that part of the Moreton district. A notable feature in the physical structure of this border range are the extensive areas in the form of plateaux that occur on the northern side, where the local streams have their origin, such for instance as the Logan, the Albert, the Coomera, the Nerang, and Christmas Creek. These have eroded away the soils along their winding courses, and cut deep gorges into the mountains where precipitous and inaccessible cliffs are met with, showing that one time in the geographical history of the country there must have been an enormously heavy rainfall associated with bolder topographical features and excessively moist climatic conditions, the vegetation of the period being dense and luxuriant. Even now there is a grand forest vegetation, and the rainfall, of some 50 inches, renders the district one of the best watered regions in the Commonwealth. Hydrographically considered it is perhaps more striking in the boldness of its physical configuration than many of the larger catchment areas in other parts of Queensland. All the tributary mountain streams occupy extremely steep boulder-strewn channels, through which the cool crystal waters from the high ranges descend in rapid torrents to join the main stream lower down the valley, where the meandering Logan sluggishly proceeds on its course to the narrow- island-studded passage separating Stradbroke Island from the mainland, a little way below the town of Alberton. But the present physical conditions of the river channel are represented on a miniature scale compared with those of former times, when the Logan covered a far larger area of basin lands, and, as a probable branch of the Brisbane River, discharged its waters into the ocean nearer Southport. The upland tributaries were then broad, torrential, boulder-studded streams of steep declivity and immense velocity, winding through mountainous country and cutting deep into the rocky ribbed ranges, whose severely sculptured, precipitous gorges and steep defiles bear silent testimony to the irresistible action of the waters that in past ages have operated so actively on the underlying strata. And evidence of such action is everywhere apparent in the basins of the streams themselves where the water-worn boulders are scattered about in all directions on the surface of the ground or embedded deep into the soils along either side of the narrow channels. This is very noticeable on upper Christmas Creek, whose bottom valley is thickly strewn with basaltic and porphyritic water-worn boulders of great size, and in places extending right back from the bed of the stream to the foot of the talus slopes, indicating that at one time in its early life history this tributary must have flown through a channel of fully half a mile in width. In consequence of such former fluviatile

TIMBER AT CHRISTMAS CREEK TERMINUS.
(*From the "Queenslander."*)

A VIEW ON WIDGEE CREEK.
(*From the "Queenslander."*)

conditions, the bottom of the valley of Christmas Creek and other local streams is now covered with the rich soils and detritus that have been washed down from the steep slopes of the adjacent ranges. during past geological ages. Particular allusion is here made to Christmas Creek, draining as it does the northern and eastern portions of the Lamington Plateau, the objective of our holiday explorations. The locality had previously been visited by a house party from "Tamrookum," in 1895, and by Lord Lamington and Mr. R. M. Collins in 1897, subsequent to which latter date a track was surveyed and cleared at Government expense right across the Plateau from west to east.

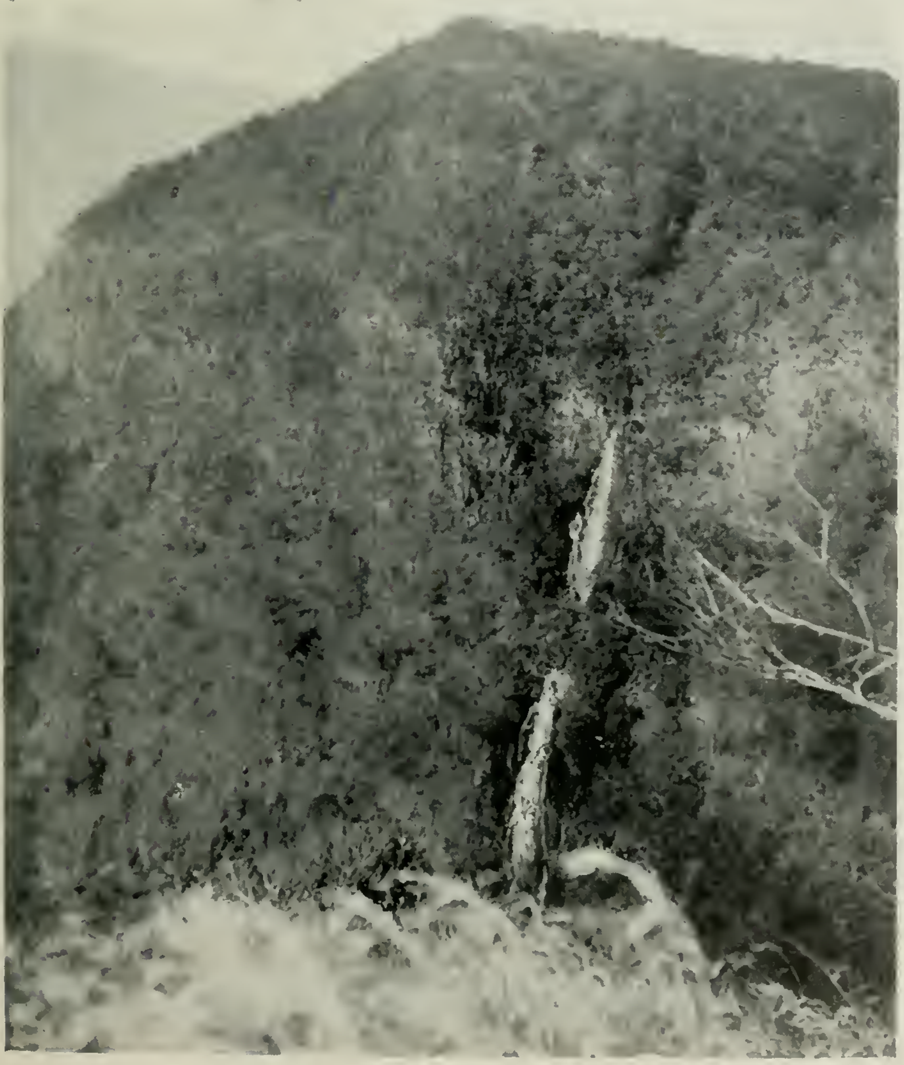
Situated in a bend of the Macpherson Range between Mt. Mungalba and Mt. Duringan, this plateau, whose area is about 22 sq. miles, embraces the country at the heads of Widgee Creek, Christmas Creek, and Running Creek, and from a scenic and climatic view point is the finest of all the border land regions. The opposite side of the range is here formed by precipitous rocky escarpments overlooking the valley of the Tweed River and right at the source of that stream, whose waters are discharged into the Pacific Ocean at Point Danger, so often frequented by citizens of Brisbane on public holidays or at such other times as the railway authorities arrange cheap excursions to this charming locality. The Plateau has a mean elevation of about 2,500 feet above sea level, the highest point being over 3,000 feet, where the range culminates in a gently sloping ridge, as yet unnamed. On the eastern side the Plateau terminates abruptly in a sheer precipice at the back of Mr. Buchanan's homestead, and it is for this very prominent feature that the name of Collins' Bluff is suggested, for the purpose of ready reference and identification, and as a slight tribute to the pioneering enterprise and genius of Mr. R. M. Collins, a former President of the Geographical Society, who with his brothers was the first to explore the ranges and ascend the Plateau, and who, moreover, has perhaps done more than anyone else to develop the district and open up the country to industrial settlement. Most of the area under consideration is clothed with forest, the top of the Plateau being covered with dense scrub, on which are included such locally known timber trees as the Bally Gum, Red Bean, Tallowwood, Crow's Ash, Rosewood, Red Beech, Pine, and Beef wood, the variety of forms being very considerable and the wealth of vegetation truly wonderful. On the creek flats and bottom lands of neighbouring valleys the timber trees are gigantic, and these are closely associated with magnificent fern palms, staghorns, and orchids, whose beautiful blossoms and graceful fronds lend a peculiar and fascinating charm to the landscape. In the valley of Upper Christmas Creek the vege-

Settler's Home Christmas Creek.
(From the "Queenslander.")

Black's Camp on Widgee Creek.

tation is most profuse and in places where the scrubs predominate the tall symmetrical timber trees are entwined, festooned, and bonded together with an almost bewildering variety of vines, creepers, orchids ferns, and wild flowers, reminding one of some immense botanical nursery or a tropical plant garden, where specially selected types are the leading feature. The whole of these indicate in a marked degree the high quality of soil and copiousness of local rainfall. But wild animal life is not so abundant as the existing and prevailing conditions would seem to favour. At one time the Scrub Turkey was very plentiful on the ranges, and Wallabies inhabited the rugged slopes of the mountains in great numbers, the latter being quite tame, when left undisturbed by the intrusive footsteps of the white man. Now these are scarce and rarely seen during the day time, their place being filled by pigeons and parrots, both of which are fairly numerous. Reptilian life is well represented by several varieties of snakes which make their appearance during the hot summer months in the scrubs and forests. But insects were not so plentiful as had formerly been anticipated. Probably the season was not altogether favourable for their development. The climatic conditions of the Lamington Plateau are probably superior to those obtaining anywhere else in Southern Queensland, the temperature ranging from 18° to 20° Fahr. lower than in Brisbane during the summer months. Even at midday, when the sun is shining brightly, the air is usually comparatively cool, dry, and exhilarating, and there is an entire absence of the discomforts of excessive humidity so commonly experienced in the coastal districts. This, in point of fact, is one of the agreeable features of the locality. There is no close muggy heat in summer, the days being cool and usually clear, the nights bright and sharp, with freedom from mosquitoes and sandflies. Forming as it does the apex of several converging valleys on the north and south sides of the range the Plateau is swept by a powerful and rapid upward circulation of air borne inland from the Pacific Ocean. And there is in consequence always a comparatively low range of temperature, the minimum being reached during the months of April, May, June, July, August, and September, when heavy frosts occur under a cloudless sky. At such times the climatic conditions are almost Alpine, except in the absence of snow and glaciers. But for health purposes these are not wanted, and we can imagine nothing more ideal in character than this beautiful and charming locality as a sanatorium for the citizens of Brisbane and others, who by force of circumstances are obliged to live in less favourable localities all the year round. Here the rainfall is abundant without excess, droughts being unknown, and the local streams carry a never failing supply of deliciously cool, clear water from the pure

VIEW FROM MR WALSHE'S RESIDENCE — UPPER CHRISTMAS CREEK.
(*From the "Queenslander."*)



WATERFALL, 600FT. HIGH.
(*From the "Queenslander."*)

sources high up in the ranges. And what can be more lovely and more charming than those mountain torrents, with their leaping waterfalls, and foaming rapids? "A full and clear stream," in the opinion of Sir Humphry Davy, "is the most poetical object in Nature. Pliny has compared a river to human life. To me a clear stream of running water is one of the most delightful, one of the most fascinating and one of the most instructive physical features in the topography of a country, affording, as it does, one of the most striking object lessons in Nature, and whose life history is a key to the evolution of terrestrial land forms. To the thirsty and weary traveller nothing is more refreshing than a draught of pure, cool water from a running mountain stream.

"The stream, a silver line of light,
  That bends along the meadows fair,
Brings ever gladness to my sight—
  At noon and eve I wander there.
'Twas near its banks I sprang to birth,
  And on its banks a boy I played;
Though long a wanderer through the earth,
  Again, my steps are there delayed.

But without in any way exaggerating it may be said that in the southern highlands of Queensland, within a few hours of the metropolis, we possess climatic and scenic advantages equal, if not actually superior to those obtaining anywhere else in the Australian Commonwealth. And these favourable conditions of climate are emphasised when it is borne in mind that the rigours and discomforts of Alpine winter so common to the Blue Mountains and other elevated regions in the Southern States are never experienced on the Lamington Plateau and neighbouring border lands. The heavy snow falls, biting winter blizzards and summer heat-waves peculiar to the uplands of temperate Australia find no corresponding phenomena on our border ranges, which are entirely free from objectionable climatic features and possess all the essential elements of a first-class health resort, both summer and winter. During the latter season clear, cloudless sky with dry and cold bracing air are the predominating features of ideal climatic conditions and these are associated with lovely panoramas of Nature and the softening influence of a rich forest vegetation. In summer the temperature is comparatively low, and the air is free from that excessive humidity usually so characteristic of coastal climate. Indeed the atmosphere is always cool and exhilarating, the evenings are invariably cold and the shade thermometrical register at midday is nearly 20 degrees below the top of the mercurial column at Brisbane, rendering

Camp at the foot of the Plateau – Tamrookum House Party.

(From the "Queenslander.")

On the Brink of a Precipice—From the Look Out—Lamington Plateau—Tamrookum House Party.

(From the "Queenslander.")

active outdoor life both agreeable and pleasant, without any of the discomforts of insect pests.

And to the west of this Plateau area, extending as far as Cunningham's Gap, the country partakes of the same interesting character as regards vegetation and scenery, there being an alternation of mountain and valley with dense scrubs and extensive forests. In official and parliamentary circles this locality was much spoken of some years ago—about 1890—in connection with the proposed line of railway from Munbilla to Warwick (known as the *via recta*). The late Hon. William Allan, who was formerly President of the Geographical Society, wrote an interesting description of the wonderful scenery of the country, declaring that he had seen nothing more beautiful, the vegetation being tropical in its luxuriance, and the mountain sides steep and precipitous.

The great impediment to a wider appreciation and more extensive utilisation of the highlands of south eastern Queensland is inacessibility. With greater and more adequate facility of access the Lamington Plateau, if dedicated to the public, would be one of the finest summer retreats and health resorts in the whole of Australasia. An extension of the Tram Line from the terminus at Christmas Creek up the valley as far as Walshe's, for a distance of some twelve miles, would land passengers at the foot of the Plateau and a zig zag road graded up the slopes from this place would enable them to reach the top. This, however, is probably a matter for pioneering enterprise, which should no longer be delayed if the best interests of the State are to be considered; and patriotism alone should prompt us to action in this case. It is indeed a serious reflection on the climate and resources of the country for our citizens to be always patronising other places outside our own borders, when healthful relaxation becomes necessary. Within sight of the metropolis and at our own doors, so to speak, we have the finest sanatoria in Australia, with associated scenery of unsurpassed beauty. At present the Lamington Plateau is not utilised in any way whatever and except as a national sanatorium its inaccessibility renders it practically useless for industrial purposes or settlement. Under the circumstances it would therefore be a wise provision to have the area set apart for public use, as a health resort, with the necessary facilities of access provided.

Taken all round the Upper Logan is one of the finest of the many fine agricultural and grazing districts in Queensland. As a sheep country it was recognised by the earliest settlers to be unsuitable and ever since the land has been given up to cattle raising and dairy farming, for which purpose it is eminently suitable, the latter being now one of the most profitable rising industries of the district, and whose

VIEW FROM THE LOOK OUT—LAMINGTON PLATEAU.
(*From the "Queenslander."*)

BUCHANAN'S FORT—FROM THE LAMINGTON PLATEAU.
(*From the "Queenslander."*)

possibilities are practically unlimited. At present all the larger pastoral runs are cut up into comparatively small holdings and homestead selection has taken the place of the early grazing farm. But close settlement is not yet an accomplished fact in this part of the country, although the dairying industry has lately made rapid strides, and the prospects of still further development are brighter now than ever before in the history of the State. The settlements are chiefly confined to the valleys, where snug and prosperous looking homesteads are scattered about in the midst of well cultivated fields or on the margin of enclosed grass lands; and all the settlers seemed to be a well-to-do class of people, with valuable holdings of the richest lands, a convenient market, adequate rainfall and salubrious climate. There are several butter factories in the Logan District, and with an extension of the excellent tram line up Christmas Creek and to other farming centres, closer settlement will obviously be stimulated and encouraged to the manifest advantage of the State, and in the interests of the local settlers themselves.

In conclusion it only remains for me to acknowledge the warm hospitality extended to our little holiday exploring party by Mr. and Mrs. R. M. Collins, of "Tamrookum," and by Mr. and Mrs. J. T. Buchanan, of "Glen Lamington," Upper Christmas Creek. To Miss Bertha Collins my special thanks are due for valuable help in connection with our photographic work.

Captain W. C. Thomson said: I have listened with great interest indeed to our Hon. Secretary's paper. It only just shows what a great mistake we make in going away from home for a holiday, when we, if we would only look around us—as he says, from Highgate Hill, and other eminences—to see these wonderful sights which lie open to us like the living book of nature. You may see the great changes—the great geographical changes, the great physical changes, and the great geological changes that have taken place in this interesting region. It has been a great treat to me to listen to this paper, which has taken us far back into the ages that the Doctor has mentioned when the dense vegetation in this part of the State sustained the great animal life, remains of which we now find in the beds of creeks and other places. Huge animals, now represented by the native bear, must have been sustained by all this dense vegetation. I am sure that you will agree with me that this lecture has been most instructive—and we must all feel that we should like to go off and have a look at the Upper Logan. It it a wonderful place, and Dr. Thomson has shown us many of its wonderful features. I have much pleasure in proposing a vote of thanks to Dr. Thomson for his most instructive paper.

Mr. L. F. Schoenheimer said: It gives me great pleasure to second Captain Thomson's proposal. The preliminary remarks of the lecturer reminded me very much of a little episode during my recent travels in America. I went into a shop to purchase some lollies, and to my surprise the young lady behind the counter did not know what lollies were. She asked: "Would I point out in the window what I wanted?" and I did so. "Oh!" she replied. "that is what we

call candy." I paid for it, and she was satisfied with the money, and the recipient acknowledged that she enjoyed the edibles just as much as if they had been lollies. And so Dr. Thomson said at the beginning of his paper that he did not know whether to entitle his paper "Holiday Ramblings on the Upper Logan," or a scientific lecture on the geological formation of the Upper Logan. It matters little what the title was. We all enjoyed it, and I am sure the whole paper was most interesting and instructive. We may be quite certain that although Dr. Thomson, with his sons, went on a rambling holiday, they must have met with a great deal of discomfort, sleeping probably on the hard ground in rainy weather, and we know that is very different to sleeping in a comfortable bed. We must appreciate efforts such as Dr. Thomson's. His lecture is of so instructive a kind, that it should be disseminated all over Queensland and among people who travel about, for by reading it they will be able to see things they might otherwise miss. Dr. Thomson to-night has shown us the scientific aspects of these regions, while the pictures that have been exhibited have displayed to us the beautiful scenery. I am sure we all have the desire to see the Upper Logan, but I for one would like to get there in an easier style than Dr. Thomson had to adopt.

Mr. C. W. Costin said: I should not like this occasion to pass without saying a few words in support of the motion to render a vote of thanks to Dr. Thomson for his interesting paper on the Upper Logan. I used to visit that part of the country very frequently in my school days, 25 or 30 years ago, and I am not surprised at the ecstasy with which he went into the beautiful scenery of the Upper Christmas Creek. No one who has the opportunity of scrambling up the ranges from the creek to the top of the nearer part of the Macpherson Range across to the Albert and Nindooimba, could fail to be impressed with the fact that there is some of the most charming country to be found in Southern Queensland. I have visited Killarney, the Barron Gorge, and the Blackall Range, and I think about Christmas Creek is some of the prettiest and the finest country for industrial occupation that is to be found in Southern Queensland. For many years there was no railway to the plains and pockets along the banks of the Upper Logan, though some of them are, I think, the richest agricultural land in Southern Queensland. Before the railway was constructed, it was impossible to get there except by journeying on horseback some 70 or 80 miles. I think Dr. Thomson has done a great service to the people of Brisbane by drawing attention so forcibly as he has done to this district, and illustrating the scenes not only of beauty, but of ordinary occupations and pursuits of the people. I have very much pleasure in supporting the motion to render him a vote of thanks.

Mr. W. Stafford said: I should like to say a word or two about the particular matter Dr. Thomson has been lecturing upon. Something like 30 years ago I spent about four years in the very same district, and more especially about Maroon, and, therefore, I can fully bear out all the statements that he has made about the beauty and the interest of everything connected with that district. I put up half a share of nearly 10 miles of heavy fencing, cutting the timber and working it, during the time of the old gentleman who owned Maroon, but whose name I forget.

Sir Arthur Morgan: Mr. Bell?

Mr. Stafford: Yes, that would be it. I know the place very well. I have been up and down the whole district; I have climbed its mountains; fished in its rivers and creeks; and I can fully endorse all that Dr. Thomson has said, for I think it is one of the most wonderful districts you can possibly go into. I have very much pleasure in supporting the motion.

Sir Arthur Morgan: It is usual to follow the reading of a paper such as we have listened to to-night, with discussion, and the matter is now open for discussion by any member or visitor who likes to take part. I may say that I have here a letter from Mr. Geo. Phillips, who is unfortunately prevented from being present with us, owing to a sudden call of duty. He has forwarded a few observations which he proposed offering had he been present. He says "Dr. Thomson's interesting paper, 'Holiday Rambles on the Upper Logan,' is another and the latest exemplification of how little of Queensland is really known to Queenslanders in general. The Lamington Plateau has been visited by few, although it is only 60 miles direct from Brisbane, and some 12 miles direct from the terminus of the Christmas Creek branch of the Beaudesert Tramway. The thanks of the Society are due to Dr. Thomson for making known to us in so charming a manner the existence and value of a plateau of unrivalled salubrity and natural beauty, having a mean elevation of 2,500 feet—that is to say, 600 feet higher than Toowoomba, 1,000 feet higher than Warwick, and as high as Stanthorpe—to reach which latter place from Brisbane, a railway journey of 207 miles is involved. The present terminus of the Christmas Creek branch of the Beaudesert Tramway is only 63 miles from Brisbane, whilst the summit of the plateau is only 12 miles further, so that the distance over which improved means of access is required is not very great. It is understood that the Beaudesert Shire Council contemplate extending their tramway some 5 or 6 miles in the required direction, which, if carried out, will only leave some 6 or 7 miles of road to be improved. An elevation of 2,500 feet within 30 miles of the sea ensures a cool and equable climate, and liable to extremes of miles of the sea ensures a cool and equable climate, and not liable to extremes of better suited in every way as a health-resort within easy access of the metropolis."

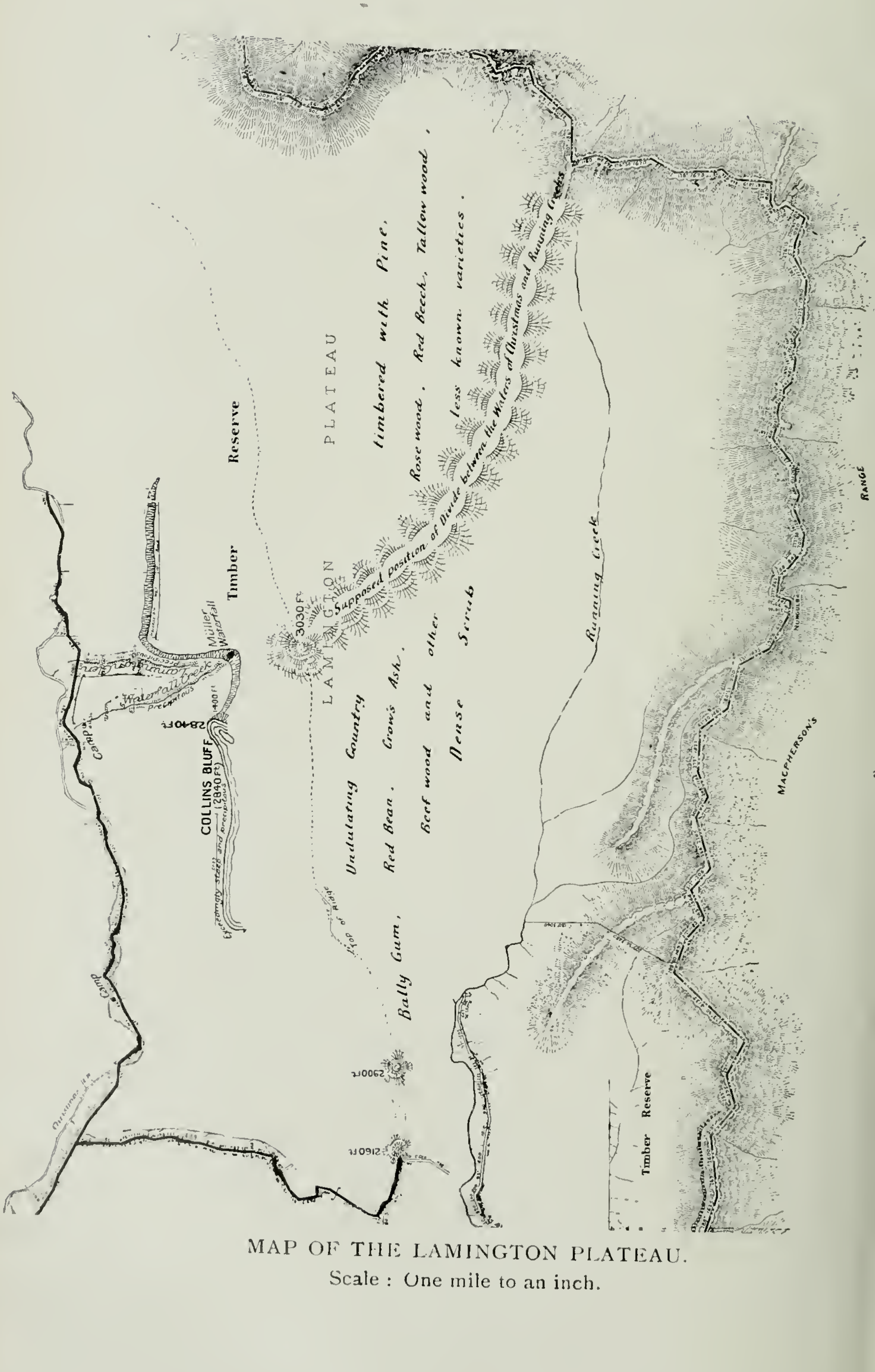
Dr. Thomson has given us a very interesting description of the Lamington Plateau and the surrounding country, and his pictures have been equally interesting. But one regrets, looking at the pictures, that Dr. Thomson had not with him a good telescopic camera, which would have given us better views of the charming mountain scenery to be observed not only in the neighbourhood of the Upper Logan, but along the main range, from Cunningham's Gap, right along the southern border to Killarney. All that has been said of the charms of the mountain scenery of the Upper Logan and of its climate, may, with equal truth, be said of the whole of the main coast range from Cunningham's Gap round by Wilson's Peak to the N.S.W. border. There you have a charming climate at an elevation sufficient to give you beautiful mountain scenery with the added charm of a plentiful supply of pure, clear water. Dr. Thomson hopes the time will not be far distant when the citizens of Brisbane will have the advantage of railway communication with the foot-hills of the Macpherson Range and the Lamington Plateau. I hope, too, that they will be brought within easy access of the people of the metropolis, and that as soon, if not sooner, they will have the advantage of easier access to the equally charming country in the vicinity of Mt Cordeau, Mt. Mitchell, and Spicers Peek. I think the Society is under an obligation to Dr. Thomson, not only for his paper, but for the excellent example he has set members by making use of his Christmas holidays to make notes for the interesting paper which he has read to us to-night. He has, as Mr. Phillips has said, brought home to a good many of us the fact that there is within easy distance of the metropolis, country so admirably adapted for a sanatorium, and he has shown, as Mr. Phillips has also said, that it is very true that the majority of Queenslanders know very little of their own country. Dr. Thomson has done very good service to the Society and to other than members, in utilising his holiday for purposes so admirable, and

I am quite sure the members of this Society will cordially approve of the motion which has been moved by Captain Thomson and seconded by Mr. Schoenheimer.

The motion was then carried by acclamation.

Dr. Thomson, in replying, said: I thank the members of the Society very much indeed for the expression of appreciation which they have been pleased to accord to the paper I have read. I have been very interested by the discussion, and I am quite gratified at the interest the paper has created. I thank you very cordially indeed. While you have been kind enough to thank me, I would feel grateful if you would accord a similar vote to Mr. Beal, who has so kindly manipulated the lantern and shown the excellent pictures.

Sir Arthur Morgan said: The Society is very much indebted to Mr. Beal for his courtesy and kindness in assisting at this night's entertainment.



MAP OF THE LAMINGTON PLATEAU.
Scale : One mile to an inch.

WANDERINGS AMONG THE TEMPLES AND RUINS IN CEYLON.*

By Mrs. W. HOGARTH.

As the mail boat slowly swings round the breakwater and lighthouse at Colombo, the traveller's first impression is, that he is gazing on some enchanted isle of fabled story. The sea and sky are of sapphire blue, and amid the green luxuriance of the tropical vegetation, the red-roofed buildings and yellow sands, gleam in the warm sunlight, making most vivid contrasts of colour. As one passes through the streets, the scene is fascinating in its infinite variety. Round one presses a crowd of many nationalities and types. There are the slender graceful forms of the Cingalese in every shade of bronze, Moormen, Tamils, Parsees, and Eurasians, with a sparse sprinkling of Europeans. The town lies at the mouth of the river Kelaniganga, and is noted for being extremely healthy. The lakes, of which there are quite a number, add to the beauty of Colombo, spanned as they are by bridges, and fringed by palm crested gardens. The writer spent a month in Colombo 20 years ago, and noted many changes. The well-known Cinnamon Gardens of those days have practically disappeared, being built over by handsome residences owned by wealthy Cingalese merchants, and let to the European residents. The picturesque bungalows are eminently suited to the hot climate. Deep porticoes adorned with pot plants of brilliant hues, open on to cool shaded rooms, in which the ever present electric fan keeps the air pleasantly in motion, while deft bare-footed servants hand the visitors iced tea and coffee. The Garden Club is also situated in the Cinnamon Gardens, and both lady and gentlemen members meet here in the late afternoons for golf, tennis, croquet, etc. We saw some excellent tennis here. Indeed, all over Ceylon, sport holds its own, and even the native cricket clubs are good, for the Cingalee is an enthusiast in the game.

The 72 miles of railway from Colombo to Kandy is a wonderful work of engineering. First, the traveller passes over long tracts of swamp alternated with belts of cocoanut palm plantations. The rubber tree is also much in evidence, planted in long rows, and our fellow travellers descant in glowing terms of the fortunes made in rubber by those who risk life and health in its cultivation. Then, as the line ascends in zig-zag fashion up the steep inclines of the mountains, one catches glimpses of lovely valleys below, and endless terraces, in which the delicate green of the paddy field delights the eye—terrace upon

* Read before the Royal Geographical Society of Australasia, Queensland, April 30, 1908.

terrace, until one realises with amazement the astonishing labour and patience of their constructors. The present generation of the Cingalee agriculturist is becoming more and more averse to the life among the paddy fields, and the Government are devising different means to encourage the declining industry. Can it be wondered at that it is a distasteful one, wading as the labourer does, day after day, through mud and slime, his wretched dwelling in some fever-haunted glade, and his whole existence one of endless toil?

Kandy, the ancient capital of Ceylon, is noted for the famous Dalada temple, containing the so-called Tooth of Buddha, which everyone knows is merely a discoloured piece of ivory, with no possible resemblance to a human tooth. The temple is built on the margin of the beautiful lake, which was formed by the last of the Kandan kings To our party, the most interesting sights in the temple were the votive offerings kept in a large cabinet in one of the rooms. These were various and fantastic, ranging from a golden lamp from the King of Siam, to tawdry flags from less exalted devotees. A leaf of the sacred bo tree, covered with gilt, was a gift from Sir Edwin Arnold.

The famous Peredeniya Gardens, are situated on the banks of the Mahavillagunga River, 4 miles from the town, and a pleasant morning was spent wandering through them. The bamboos are gigantic, and those in the Brisbane gardens would seem dwarfs beside them. The various palms were a constant delight to our party, and we soon mastered the differences of each. The tailput palm or king of palms, with its huge umbrella-shaped leaves--the traveller's palm, so-called from the water contained in the end of the leaf next the trunk—the areca palm of betel-nut fame—the palmyra palm—and last but not least, the cocoanut palm, which, for ages, has been used by the natives in all sorts of ways.

The railway from Kandy to Nuwara Eliya winds up to an altitude of 6,200 feet, and during the seven hours in transit, gives the traveller views of the grandest and most varied scenery all the way. Here a valley steeped in a golden haze, there a mountain torrent hurling itself down a narrow gorge, then a cascade falling like a bridal veil in a glittering spray, or again a rugged group of granite boulders, round which the tendrils of hugh creepers have clung, and amid which immense trees rear themselves majestically. The blood wood (lagerstraemia regina) is extremely beautiful with its rose-coloured flowers, and the iron wood or flame tree is brilliant with its great scarlet shoots. At times the line curves completely round, making the most marvellous horseshoe bends, and twisting in serpentine fashion up the sides of the hills, now rushing through a tunnel in the mountain, then as it emerges, seeming to hang suspended over a precipice, without apparent support, the girders being invisible from the carriage windows,

as one gazes down at appalling depths below. The rocky peaks of the Great Western Range assume weird and curious forms. One is like a lion couchant, another gives the idea of a battlemented castle, while a third bears a striking resemblance to a recumbent camel.

Soon after leaving Kandy, one sees the first tea estate. It has been found that the elevation best adapted for the plant is from 4,000 to 6,000 feet above sea level. The soil is a rich chocolate loam, composed of disintegrated gneiss. No fence or hedge divides each estate, so that one looks upon an almost unbroken vista of the dark-leaved plant, which is of the family of the Camelia, and has the distinctive glossy green of that shrub. Up the sides of the hills in almost perpendicular heights, the tree is planted in rows about 3 feet apart, till one wonders how the necessary cultivation is carried on, and pictures the coolie hanging on by his eye-lids as he pursues his task. There are occasional rows of grevilia (silky oak) as shade trees among the tea. Each estate has its factory, manager's bungalow, and coolie quarters, and the different processes of drying, sorting, and packing are most interesting to a visitor. The best result is obtained when the leaf can be dried naturally by the action of sun and air, but in the frequent rainy periods, artificial means have to be resorted to, and large fans are constructed above the tiers of trays, upon which the leaves are spread. The pickers are Tamils of both sexes, and a smart picker will gather as much as 20 lbs. in the day. Each coolie carries a basket on the back, and is provided with an umbrella, and in the cooler season, with an overcoat. After passing Hatton, we caught our first sight of Adam's Peak, 7,420 feet, which is a most prominent and beautiful object.

The last hour of the journey has to be completed in a small, narrow gauge railway, and the traveller leaves the train at Namoya, and enters the toy carriages, which are to convey him to Nuwara Eliya. Again the line turns and twists up the steep incline, and each moment the air becomes fresher and cooler, and the traveller has recourse to his long-discarded wraps and rugs.

Nuwara Eliya is 6,210 feet above sea-level; Pedrotallagalla, which towers like a monarch above the town, obtains a height of 8,280 feet. His summit, except in the early morn, is usually draped in clouds and mist. To climb Pedro. is the ambition of all visitors to Nuwara Eliya. Our party began the ascent at 6 a.m., and returned about 10, having enjoyed a clear panoramic view.

Owing to the extensive denuding of the native forests, which would in time affect the rain fall, the Government has found it necessary to plant largely, and the Australian visitor recognises many old friends in the timber reserves. The different varieties of eucalyptus, the grevilia, or silky oak, many of the wattle or mimosa family, and the

swamp or she-oak are planted for miles in every direction. Strange to say, the wattles are grown chiefly for firewood, as in a year or two in that moist climate, they reach goodly dimensions. The rhododendrons about Nuwara Eliya are quite large trees, and in the spring, the rose-tinted blossoms must have a charming effect.

Nuwara Eliya is the sanatorium of Ceylon. The days are warm, but the nights are cool and bracing, and one is glad to sit round a cheerful fire. Surrounded by hills clothed with verdure, with charming walks and drives, from which, at every turn, lovely views of mountains or lakes are seen, with picturesque cottages and pretty gardens, Nuwara Eliya is an ideal holiday resort. One meets here visitors recuperating from Burmah, lower India, and from all the less favoured parts of Ceylon itself. Some of the English fruits grow well (the strawberry and raspberry): there is also excellent snipe shooting in the neighbourhood. The English ladies drive about in small carts drawn by the quick, sure-footed oxen, which are safer than ponies in the steep inclines. A visit to a dairy at milking time was instructive and amusing. At least 5 natives were required to milk one cow. One tugged at her head, another twisted her tail to propel her forward to the bail, a third stood ready with the milk pail, while two others dragged the calf in sight of the mother, for otherwise no self-respecting native cow will allow herself to be milked.

Quite close to Nuwara Eliya are the so-called Moon Plains, where some beautiful stones have been found. A drive to the experimental gardens at Halkalla, 7 miles distant, made a very pleasant afternoon excursion.

A quaint old Dutch cemetery at Nuwara Eliya is an interesting relic of former days. Dark, gloomy cypress firs overshadow the crumbling tomb stones, and it is here that Major Rogers, who was killed by lightning in 1835, is interred. He was a great hunter, and is said to have slaughtered 2,000 elephants, and affixed the massive skulls round the walls of his compound. The Buddhist priests of that day looked with horror on the shedder of so much blood, and (so the story runs) called down the vengeance of the Powers above upon him. Shortly afterwards, as he was ascending the Ramboddi Pass with his company, during a violent storm, he was struck by lightning and killed. Strange to relate, twice since he was laid to rest a flash of lightning has also struck his tomb stone, on one occasion shivering the tree to fragments that was planted at the head, and a second time splitting asunder the stone itself.

No sheep of any kind are depastured in Ceylon. We were told of the tragic fate that befell a small flock which a reckless enthusiast imported there some years ago, in the vicinity of Hatton. In the low lying valleys leeches abound, and these crawled up the nostrils of the unfortunate animals and killed them.

Gangs of about 14 native convicts may often be seen working in the public gardens, or on the roads, in charge of one native policeman. Their dress is yellow and white striped dungaree, and they look fat and healthy, though their only food is rice, with occasionally a little coarse bread.

Returning to Kandy once more, we again left it at 3 o'clock in the afternoon, and arrived at the railway station of Anuradhapura at 9 o'clock in the evening. A drive of about a mile in a quaint little bullock cart, through the warm-scented dusk of the tropical night, brought us to the very comfortable Rest House. This is under government control, and the traveller receives every attention, and the charges are most moderate. We were warned to lock our bedroom doors whenever we left the room, and there are iron bars across the windows to allow of fresh air at night, while every aperture is securely bolted against the intrusion of any mid-night prowler.

The stupendous ruins of the ancient city are quite near to the Rest House. Two thousand years ago Anuradhapura was a thriving city of 16 square miles, and with a teeming population in the surrounding country. This is the more difficult to realise, as the whole district is now most unproductive and wretched. Low-lying swamps and dense jungle surround it, and it is feverish and unhealthy.

The granite pillars forming the foundation of the palace of a thousand rooms, nine stories high, stand close to the largest and finest Dagoba, the Thuparame. The Dagobas are round bell-shaped structures, resembling in contour the Pagodas of Burmah, are composed of a solid mass of brick masonry, and were shrines to Buddha. With the exception of two partially cleared and repaired under the supervision of the Archaeological Society, they are covered from base to summit with large trees and a tangled undergrowth. So stupendous are these monuments, that I can only compare them in size to the third largest of the Pyramids in Egypt.

The Jetawanarama Dagoba is 250 feet high, and its diameter is about 360 feet. It has been calculated, says Sir J. T. Tennant in his book on Ceylon, that to construct such amount of masonry even at the present day, would occupy 500 bricklayers from 6 to 7 years at the cost of over a million sterling; and it is said there is sufficient material in the two adjacent Dagobas to build a street of houses two stories high from London to Edinburgh. Five gigantic statues of Buddha are here, found in the ruins of the adjoining temple. In every case the head has been destroyed by the Portuguese in the hope of discovering precious stones which were sometimes hidden in a cavity in the skull. It is also known that a subterranean room existed in each of these Dagobas, which were also plundered by the Malabar and Portuguese invaders for the sake of the treasure contained therein:

and it is believed that in the Jetawanarama such a vault still exists, with its Buddhist secret stores still intact.

We were shown over the ruins by an intelligent Cingalee student, educated under the auspices of the Archæological Society. He was almost a dwarf, with an intellectual cast of features, his age about 30, and Mr. Bell, of the Society, so we learned later, trusted and thought highly of him. His quaint remarks were a constant source of amusement to us. He had a very poor opinion of a certain European scientist, who has lately visited these buried cities and published a monograph on them—"Sir,—says so and so in his book, but I and the Archæological Society consider him wrong."

Each Dagoba originally had four temples connected with the main structure, built facing the four cardinal points of the compass. A huge granite platform flanked by octagonal stone columns of unequal height, still remain, and indicate the chief approach to the largest Dagoba. This entrance must have been covered by a domed roof, richly ornamented, as were also the walls of the Dagoba.

These Dagobas are under the charge of the Buddhist priests, whose vihara or monastery of modern construction is always in the near vicinity, and the Government is particularly careful not to offend their susceptibilities in any way. Dressed in long, yellow robes, they stand at the doorway of the temple, and gratefully accept a small donation, though poverty as well as celibacy is enjoined by the tenets of Buddhism.

They have clear-cut features, clean-shaven head and face, and their bearing is calm and dignified.

To speak of Anuradhapura without a reference to the sacred bo tree (ficus religiosa) would be the play of Hamlet, with Hamlet left out. It holds the record of being the oldest tree in the world, having been planted in 288 B.C., and consequently is now 2,196 years old, and Sir E. Tennant states that there is historical evidence to prove it really is of this hoary antiquity. It is by no means a shapely tree. Wide-spreading branches straggle outwards from the main trunk, some resting on the wall that encloses it, and others supported by artificial props. All Buddhists regard it with the deepest veneration, for it is believed to have grown from a cutting of the sacred ficus beneath which Gantama lay, when he attained the great peace. It is considered sacrilege to pick a leaf, but those that fall to the ground may be gathered. The temple beside the tree was crowded with worshippers, bearing trays of lotus flowers. To one who has ever seen the pale, pure pink of its exquisite petals, and noted the singularly chaste beauty of its form and colouring, will cease to wonder that in Eastern lands the lotus is esteemed a flower of the gods. It figures largely in Egyptian hieroglyphs, but the Egyptian species is white, while those we saw in the temples of Anuradhapura were a delicate rose.

Seven miles from Anuradhapura is the rock and temple of Mahintale, perhaps the most interesting of all the ruins, for it was here that Mahindo, the Buddhist propagandist, about 300 B.C., after having converted the king, erected the first monastery, and is said to have held forth to the people from the pinnacle of the rock, which is still called "The Preacher's Rock." A flight of 1,000 (originally 1,900) granite steps leads up the hill to the foot of this singular pulpit. The most matter-of-fact and prosaic mind could not fail to be stirred to some emotion when looking upon these remains of a by-gone past. A small level plateau crowns the hill of which the Preacher's Rock is the central point, and on this plateau are the ruins of the temple and monastery, grand in their decay. Broken columns lie on the ground—cisterns, altars, and a statue of Buddha and of the king, bear dumb but eloquent testimony to the vanished greatness of those far-off days. The imagination tries to reconstruct the scene of barbaric splendour. Gone now are the glittering pageant, the long procession of priests, the multitude of worshippers. Only the guttural cry of the wanderoo ape breaks the silence; while two grave-sad faced priests guard the ruins of this once famous sanctuary.

Some of the most remarkable vestiges of a departed civilisation are the ruined tanks, which are absolutely colossal. A drive past one of these immense reservoirs, which has been restored by the English Government, gives one a very realistic idea of the importance of the ancient city of Anuradhapura. The engineers who could construct irrigation works on such a gigantic scale must have been possessed of skill and knowledge rivalling those of the engineers of our own day. It was a delightful drive past the restored old enbankment, for a cool breeze from the broad expanse of water tempered the tropical heat. It took away from one's pleasure, however, to learn that there were repulsive crocodiles in this lovely lake, and a short time before, a boy had fallen a victim to one when bathing. A visit to some ruins quite recently excavated, which are called the Elephants' Stables, reveal the secret of one of the means by which these vast undertakings were carried out, and it is evident that the enormous strength of elephants was freely used in the necessary haulage, etc.

These stables are about an acre in extent, and prone slabs and pillars, testify to the extraordinary massiveness they once possessed. A trough 16 feet long, hewn out of solid granite, is supposed to have been a receptacle for the animal's food. Similarly titanic are the ruins of the so-called Elephants' Baths, where it is believed they were taken to disport themselves after their daily work was done. Not far from here are the ruins of the king's palace, at the entrance of which is a large flat crescent-shaped stone, called a moon-stone, of which several have been found among the buried cities. This, however, is considered

to be the finest specimen of stone carving that has yet been excavated in Ceylon. Round the outer edge there are thirteen figures in bas relief, of the lion, horse, elephant, and bull, signifying the thirteen months of the Buddhist year; while on the inner circle of bas relief is depicted the sacred goose thirteen times repeated. The carving is most exquisite and quite faultless. No chisel or sculptor's tools of any kind have been found, and it is conjectured that the long-forgotten artists who wrought this imperishable record of their genius were brought over to Ceylon from the main land, and when their task was completed, they returned, taking their tools with them.

Our ast impression of beautiful Anuradhapura is one that will linger long in the memory.—A glade of tall spreading trees, through whose leaves the light fell in broken shafts upon a colossal figure of a seated Buddha, cross-legged, with a cloak over one shoulder draping the figure. Through all the centuries that have passed it by, the expression of passionless rest remains fixed and unalterable, and a curious impression of awe and solemnity seizes the beholder. So aloof from the world it seems in this solitary place, amid the oppressive stillness of the jungle, that we turned away with lingering steps, almost with the feeling that the spot on which we stood was holy ground.

DUNK ISLAND.—ITS GENERAL CHARACTERISTICS.*

By E. J BANFIELD.

DISCOVERY AND NAME.

In common with most of the notable features of the East Coast of Australia the discovery and the baptism of Dunk Island are to be credited to Captain Cook.

On 8th June, 1770, he wrote :—" At noon we were by observation in the Lat. 17° 59′, and abreast of the north point of Rockingham Bay, which bore from us N. 2 miles. This boundary of the Bay is formed by a tolerable high island known in the chart by the name of Dunk Isle ; it lays so near the shore as not to be distinguished from it unless you are well in with the land."

One of the first of several stereotyped questions of present day visitors is—" Why is your island named Dunk ? What a queer name for such a lovely island ! " Good Captain Cook did not bestow his titles out of mere caprice, and without rhyme or reason. They were almost without exception, commemorative of some event or some mischance that his expedition suffered, or bestowed in honour of some significant man of his age, or intended to fix beyond doubt the identification of some necessary feature of the new and strange lands his voyages made known.

" Dunk " finishes an apt combination of geography and biography, by which Cook immortalized his " noble patron "—the Earl of Sandwich—whose titles and name he subsequently linked with the New Hebrides, the Sandwich Islands, etc. Halifax Bay, " Mount " Hinchinbrook (Cook did not realise the existence of the Island), Cape Sandwich, and Dunk Island are associated with that nobleman, whose family name was John Montagu Dunk. He was the First Lord of the Admiralty in Rockingham's ministry, and Pepys—who in one of his letters tells of a visit to " Hinchinbroke "—claimed him as a friend.

Not that Lord Halifax, the Earl of Sandwich, the owner of Montagu House and the fair domain of Hinchinbrook, depended entirely upon Cook for immortality, for by the invention of the sandwich as a means of hasty refreshment during strenuous gambling fits, he enriched our language by a universal term. And in Koonanglebah Dunk Island has a title older and of sweeter sound than that prescribed by Cook, and its own coast line and its sister isles are bedizened with names in comparison with which modern usurpations are anything but sonorous.

* Read before the Royal Geographical Society of Australasia, Queensland, May 28th, 1908.

In but one case have I interfered with local and time-honoured nomenclature. Upon the day of my landing, I was most pleasingly impressed by the number and variety of butterflies on the margin of the dainty harbour, and it occurred to me that an appropriate every-day name would be the aboriginal term for the lovely and conspicuous insect. "Cookee-Cookee," however, seemed an anti-climax as well as a trivial though endearing play on the name of the discoverer of the Island. It was therefore thought humane to borrow a term from the vocabulary of the Palm Island blacks, with a slight amendment of pronunciation as a concession to brevity. "Brammo" Bay accordingly stands for butterfly, and butterflies, it may well be hoped, will for ever by their illuminating presence render lettering superfluous. Justification for the title does not depend solely upon personal opinion. Half a century prior to my date MacGillivray, the naturalist of H.M.S. Rattlesnake Expedition, made an enthusiastic note of the number of butterflies in the vicinity of the Bay, though I was not aware of the fact when "Brammo" was proclaimed.

Though small in area Dunk Island has made several original contributions to natural science. MacGillivray (1848) specified "a wild species of plaintain or banana" (probably Musa Fitzalani), that pretty little bird whose eggs are still unknown to ornithologists—the White-eared Fly-catcher (Piezorynchus leucotis), a singular land shell (Helix dunkiensis), and a great spider which spins a golden-tinted web (the Olivaceous-bodied Nephila). He also mentions a butterfly of "great size and splendour" (Papilio Ulysses), but whether it is to be credited to his Dunk Island list does not appear. A fruit rat, referred to elsewhere, and two orchids described by Mr. F. M. Bailey, F.L.S., are more recent discoveries.

Some Physical Features.

Dunk Island is situated 110 miles up the coast from Townsville and about 60 miles south from Cairns. It is merely a range of hills running parallel with the main coast range—high and bluff at the northern extremity, broad and bulging in the waist, and falling away, to a somewhat shabby and common-place ending—low, narrow, and comparatively barren—to the south, while a central spur points towards the S.W. The superficial area is about $3\frac{1}{2}$ sq. miles; greatest length three miles; greatest breadth about two miles; and the coast line measures between ten and twelve miles.

The eastern aspect offers the cold shoulder to boats, the two tiny, shallow, ill-sheltered, boulder-strewn, yet picturesque coves being hospitable only in mild weather, when indeed, their hospitality may be ignored, for landing is then safe and easy at many places

Steep, forest-clad declivities, baby precipices of grey granite aureoled with orchids, entangled jungle from the splash line of the Pacific to the crest of the range ; fantastic rocks, linked and corniced and skirted with oyster masses ; grey-fronded palms springing from clefts among austere boulders ; grassy slopes, with groups of pandanus palms in damp hollows, and again forest and jumbles of rock, characterise the weather side.

On the sheltered western aspect the less steep hills, wrapped in a patched but rentless mantle of leafage, rest upon a level plateau containing about 300 acres. This plateau has an elevation of from 10 feet to 80 feet above a sandy low-lying flat, drawn out into a western pointing spit by the never-ceasing action of the sea under alternating breezes from S.E. and N.E. The conformation of this plateau and its relation to the flat are certainly to be included among the distinguishing features of the Island. Undoubtedly the steep bank is the old strand line, the flat being of quite recent date, although for the most part covered by forest. In some places the bank is at least half-a-mile from the sea, which in others at high water spring tides still sweeps its base. Sharp sand free from vegetable stainings, shells with lustre but slightly tarnished and coral—white though worn—exposed on denuded faces, testify to the newness of the sandy flat, while big trees growing on the very verge of the sea seem to confute the recent records of the glittering shells and clean coral.

Though the ancient strand line ranges from 10 feet to 80 feet above the level of the flat, its general elevation is about 40 feet. Now, the greatest depth of water between the Island and the mainland is 9 fathoms, the average being about 6½ fathoms. Therefore the superiority in elevation of the plateau to the sandy flat almost exactly coincides with that of the flat above the bottom of the channel. Within the area embraced by the fringing coral reef of Brammo Bay, there has been a noticeable decrease in the depth of water in ten years. During that period two or three acres have degenerated into a wet desert, the site of what was formerly a lovely and fantastic marine garden having become a depot for mud, worn shells and coral ugly in its dinginess and decay. Fresh areas of the ocean floor beyond are, however, being rapidly planted in that haphazard style in which all these subaqueous gardens are laid down.

No doubt the present elevation of the old strand line indicates a corresponding diminution in the depth of the adjacent sea ; and the destruction of the coral nearest to the existing beach and the springing up of a new fringing reef beyond, seem to indicate a further development of a process constantly in action, the eventual results of which are obvious and inevitable—the filling up of all the sea space within the

Great Barrier Reef, and the gradual lessening in depth of the whole of the Coral Sea.

According to official data the highest point of the range—the northern extremity of the Island—is 870 feet above sea level ; the second peak is 725 feet ; the third is 720 feet, and thence there is a gradual descent along a razor-back ridge into a col about 100 feet ; thence a rise to the fourth peak about 650 feet, whence the land falls away in a steep bluff and trails off to its mean ending, with the rocky islet of Wolngarin as a full stop. The aboriginals distinguish the principal heights by the following names : Coo-tahl-oo (osprey), Tarn-coo-rah-ghee (a species of edible yam), Cut-tay (spear or yam stick), Tahl-oo (fishing or harpoon line), Gill-gill (lawyer vine).

Granite, slate, micaceous schist, with numerous quartz veins and blows are the chief geological features. While the heights to the N. reveal little else but slate, that part of the Island to the south of the deepest col is composed almost solely of granite the more elevated areas being an almost inextricable jumble of huge blocks overgrown with vegetation and therefore but partially discernible from the sea.

Four creeks—two of which are usually in a state of suspended animation from the middle of September to the middle of November—water the western face, while during the long wet season and for months thereafter, hasty little torrents tumble down the Pacific slope and end their flurry and fuss by a heedless plunge into the surly sea.

Climate.

As Dunk Island lies only 24 miles south from Geraldton, the wettest place in Australia, it participates in the blessing of abundance of rain. On this point a few figures must speak for themselves :—

Average annual rainfall, 123 in.

Average number of days on which rain occurs during the year, 108.

Wettest month—March, with an average of 23.95 in.

Wettest single month during a period of nine years—February, 1906, 56 in.

Heaviest rainfall during 24 hours, 12.20 in., 6th February, 1906

Driest month, October, with an average of 1.20 in.

It seems fitting and quite safe to point a moral by an allusion to certain conditions prevalent during the present season (1907). Between 1st January and 30th June, 80.80 in. of rain were registered. July, August, September, and October provided only 1.74 in., which quantity bespeaks quite a phenomenal drought. The catchment area of the creek which discharges into Brammo Bay is less than 40 acres, and for the most part consists of exceedingly steep declivities. The head of the creek is 700 feet above sea level and its total length less

than three-quarters of a mile. Yet notwithstanding the circumscribed extent of the catchment, the steep—in places almost precipitous—descents, and that for four months the rain was insufficient to cause a surface flow, the creek, which has cut a gully or ravine 40 feet deep across the plateau, never ceased running, the turbulence of the wet season having merely subsided into a tinkling trickle. During the dry period the atmosphere was the reverse from humid ; but the almost inpenetrable shield of vegetation—the beauty and the glory of the island—discounted loss by evaporation. One can well imagine that in the absence of this gracious protection, the creek would cease to flow a week or so after the cessation of rain.

The marked but consistent decrease of water in the Creek by day and its restoration during the night having excited interest, a series of measurements was taken, the result being somewhat surprising. One day's readings will suffice, for scarcely any variation from them was recorded for weeks, the meteorological conditions undergoing no sudden or decided change while the experiment was in progress :

Sunday, 10th November, 1907.

6.30 a.m.	$10\frac{1}{4}$ in.
9 a.m.	10 in.
Noon (high tide)	$6\frac{5}{8}$ in.
3 p.m.	3 in.
5.30 p.m.	$1\frac{1}{2}$ in.
6.10 p.m. (sundown)	$1\frac{1}{2}$ in.
7.10 p.m.	$3\frac{7}{8}$ in.
9 p.m.	$10\frac{1}{8}$ in.

At 7 a.m. on the 11th and 12th the water stood at $10\frac{1}{4}$ in., and I assume that to have been the constant level throughout the night.

The conclusion I draw (rightly or wrongly) from the fact emphasised by these figures is, that the mass of vegetation exercises a direct and immediate effect upon the flow of water. A continual and increasing demand for refreshment existing during the day, the root spongioles are in active operation, intercepting and absorbing moisture ; while with the lessening of the temperature on the going down of the sun the stomata of the leaves begin their functions, and by the absorption of gas react on the root films, which for the time relax their duty of arresting the passage of minute particles of moisture, with a definite result on the nocturnal flow.

No local data as to temperature being available, the figures presented are derived from the mean between Cardwell ($18\frac{1}{2}$ miles to the south) and Geraldton (24 miles to the north), each place being practically at sea level. A slight allowance has been made on account of the influence of the constant sea. Therefore the figures cannot be far

from the accuracy which science demands : Mean temperature, 69° ; hottest month, January, with a mean of 87° ; coolest, July, with a mean of 57°. The highest temperature recorded at Cardwell was 103.3° ; the lowest, 36.2° ; at Geraldton the extremes were 96° and 43.4°. Under this equal sky, the air is warm and soothing ; seldom it is crisp, and never really bracing ; and though during the wet season the moisture ladened air may be likened to a vapor bath, the climate is so wholesome that ordinary precautions for the prevention of sickness are generally neglected, without fear of ill consequence. If I were to assert that the climate of Dunk Island is the healthiest in the world, it would be to risk the retort that an indecently biased person might at least assume the virtue of muteness on such a point. Yet, unless my own experience is exceptional, the fact remains, and however agreeable to my choice is not of my making

Flora.

The Island has so long been separated from the mainland by two and a half miles of shallow sea, that it possesses certain distinctions which form most interesting subjects for observation and study.

Except on the narrow hard S.E. end, and a few acres of sand spit, and some of the steepest declivities of the Pacific slope, the whole surface from high water mark is covered with luxuriant vegetation, partly forest, partly jungle.

Chief among the trees of the forest are : Bloodwood (Eucalyptus corymbosa), Moreton Bay Ash (E. tessellaris), Red Stringy Bark (E. robusta), Paper-barked Tea Tree (Melaleuca leucadendron), Umbrella Tree (Brassaia actinophylla), recorded 60 years ago, and still a most conspicuous and handsome feature ; Gin-gee (Diplanthera tetraphylla), Swamp Mahogany (Tristania suavelons), Terminalia melanocarpa, Raroo (Careya australis), several varieties of acacia and also several varieties of figs ; Screw Palms (Pandanus odoratissimus, P. aquaticus, and P. pendunculatus). Three or four varieties of Hibiscus are to be included among the shrubs and small trees, with the Indian Mulberry (Morinda citrifolia), the beach-loving native cabbage (Scævola kœnigii), and a host of others scarcely less conspicuous.

Nearest the sea creeps and crawls—lover of the salt sand that it is—the Ipomea pes-capræ, with the sweet-scented Canavalia obtusifolia in close companionship; while the lowly trailer, Vitex trifolia (which responds to every inconsiderate footstep with an expression of agreeable pungency from its sage-green leaves and watery blue flowers) fulfills its office as one of the chief among the sand consolidators.

One misses the cycads, though grass trees (Xanthorrhæa arborea) with twelve and fourteen feet scapes, are plentiful on the barren area ; the native sarsaparilla (Hardenbergia retusa) over-runs the sandy flat ; one variety of native ginger (Alpinia cærulea and its ally, Elettaria Scottiana), and two varieties of raspberry (Rubus moluccans, and R. rosæfolius) commingle with many other plants in the fringes of the jungle.

On the beaches are found Barringtonia speciosa with large handsome flowers and huge angular fruit ; Carapa moluccensis, bearing a fruit almost as large as a coco-nut, in which are tightly packed a number of odd shaped seeds ; the incomparable Alexandrian laurel or Doomba tree (Calophyllum inophyllum), the Flame tree (Erythrina Indica), Poonga Oil tree (Pongamia glabra), the Beach Oak (Casuarina equisetifolia), the Looking-glass tree (Heritiera littoralis), with silvery-backed leaves and boat shaped fruit ; Cerbera odollam, its fruit of fine presence, glossy red and large, but compact of fibre, pith and bitterness ; the Indian Tulip tree (Thespesia populnea), with large pale yellow flowers blotched with maroon and buds and unripe fruit exuding a viscid juice, rich gamboge in color ; the sea-coast Laburnum (Sophora tomentosa) —silvery fur on its grey green leaves and flowers of golden yellow and mignonette-like odour ; Hernandia peltata with black fluted nuts loosely enveloped in a fleshy " bell " which changes from yellow to pink, and from pink to red ; and again several varieties of Ficus.

Conspicuous among the confusion and crowding of the jungle are the Milkwood (Alstonia scholaris) with huge bole supported by flying buttresses, and from every wound in the bark of which there freely flows a milky sap ; Quandong (Elæocarpus Bancrofti) with sky blue fruit and quaintly pitted stone ; Bean tree (Castanospermum Australe), provider of the principal food of the blacks ; Native Nutmeg (Myristica insipida) ; the Australian Cashew Nut or Marking Ink Tree (Semecarpus australiensis) ; Bird-lime tree (Pisonia brunoniana) which unconscious in its cruelty and by means of an excessively viscid secretion from the seeds condemns insects and even birds to lingering deaths ; three varieties of Eugenia—White Apple (E. grandis), E. suborbicularis and E. Luehmanni ; cork bark (Evodia accedens); kirri-kue (Eupomatia laurina), greedily admired of the blacks because of its spicy and astringent fruit ; Herbert River Cherry (Antidesma Dallachyanum) ; Finger Cherry (Rhodomyrtus macrocarpa.) This latter bears a fruit as pleasant to the palate as the Cherry Guava, from which a delicious rose-tinted, rose-scented jelly may be compounded, yet it has a dubious reputation, being credited with causing blindness and even the death of those who eat it. Yet the blacks consume large quantities and have naught but praise for its qualities. Possibly the poison (if it exists, and

personally I have never found the fruit cause the slightest inconvenience) is a nerve-irritant of which the blacks and most whites are tolerant. Nor must I omit to mention the stately bananas—Musa Fitzalani and M. Hilli—with fruit so packed with bony seeds that there is scarcely room for pulp and very little for flavour.

This list provides but a paltry recognition of the hundreds of interesting trees which in the mass constitute the jungle, and yet some varieties common on the mainland are unrepresented, notably Davidsonian plum (Davidsonia pruriens), Northern Silky Oak (Cardwellia sublimis), Maple (Flindersia chatawaiana), and Stinging tree (Laportea moroides). But the Ficus family is predominant with shrubs and parasitic and stately self-supporting trees, both in forest and in jungle.

Palms are entitled to particular mention, for they include Alexandra (Archontophœnix Alexandræ), local Black Palm (A. Jardinei), Fan (Licuala Muelleri), Cabbage Tree (Livistona australis), Native Date (Caryota rumphiana), and also what I believe to be Calyptrocalyx Australasicus, as well as two of the creeping varieties (lawyer vines), Calamus obstruens and C. moti. One growth of the former I found on measurement to be exactly 1½ in. diameter and have reason to believe it to be exceptional.

Nothing has been said of the many special, entertaining plants that go to form a mangrove swamp; nor of Crinum lilies which scent the purlieus thereof; nor of the bewildering varieties of ferns with that lovely climber known as the Fern of God (Lygodium reticulatum) at the head of the list, and the frail translucent Trichomanes parviflorum, and the Mother Fern (Asplenium bulbiferum) which coddles its young until they are strong and hearty and well capable of sustaining a separate existence, and the great stemless Potato Fern (Marattia fraxinea) and slim shafted Alsophilla Rebeccæ, and the graceful Ribbon Fern (Vittaria elongata), just as samples of the rich collection.

Nor have I catalogued any of the vines (other than the two palms) that with warp and woof fabricate the leafy mantle; or the orchids, terrestrial and epiphytal, from the great showy Phaius grandifolius with its scape (four feet long) crowded with flowers reminiscent of the Foxglove in size and colouring, to the diminutive Corysanthes fimbriata, leaf, flower and tuber of which might rest on the thumb nail with space to spare; nor have I specialised (as they deserve) the many kindly plants that disseminate those " tiny volatilised particles in the air which constitute a smell"; nor ventured to signalise those curious epiphytes that ever perform wonderful aerial suspension feats dangling mid air, or clinging to reluctant hosts in agony of anxiety; nor the massive cables of the Matchbox Bean (Entada scandens), the pods thereof

(over three feet long) robust trees advertise in the unseemly jumble as their own.

These references merely touch the rim of the botanical wealth of the Island. And yet amid all this " gay, theatrical " profusion, and with nothing but thankfulness for it all on the lips, it might be asked was nature merely absent-minded in the presentation of edible fruits while so many are fair to the eye ? Why did she not endow the Island with but one—only one—sweet nut ? She gave to the glorious many-branched, shade-creating Calophyllum pink timber, durable and grained with all the curls and curves of beauty, and polished leaves laced with the palest gold, and white and gold flowers deliciously scented, and nuts great in number, and cram-full of meat—so bitter, alas ! and so crude and unpromising that the blacks, who patiently convert the poisonous bean of the Moreton Bay chestnut into wholesome and nourishing food, and the tough fibrous rhizome of the Bowenia spectabilis into stuff that at least pacifies hunger, can do absolutely nothing with them. What an opportunity Nature lost ! If to the otherwise generous graces of the Calophyllum she had added the qualities of sweetness and wholesomeness to the nut, what an immense difference might have been wrought in the stamina of the aboriginal, and in what a shrill key might the present praises of the tree have been pitched !

Here I may be permitted to record my joyful indebtedness to Mr. F. Manson Bailey, F.L.S., for encouragement in my amateurish investigations into the botany of the Island by the ready identification of specimens.

Fauna.

Exceptionally rich in its flora, Dunk Island exhibits extreme poverty in mammalian life. The largest four-footed creature, the Spiny Ant-eater (Echidna hystrix) is by no means rare ; and the Flying Fox (Pteropus funereus), though not strictly speaking a resident, comes in sufficient numbers, but at irregular intervals, to be almost a nuisance. The Small-toothed Bat (Scotsphilus microdon) is common and another species (identity not ascertained) very rare. A great brown rat with white-tipped tail—Uromys macropus (?) occurs, but must be exceedingly scarce, for during ten years but one specimen has been seen and that was revealed on the post-mortem examination of a rock python 12 feet long. The blacks assert that these rats are " close up all finish now." Possibly the snake was responsible for the temporary custody of the last representative of the race. If there are any survivors the number must be most forlorn, otherwise my Irish terriers, keen-scented and the keenest of hunters, would have discovered them ere now.

Next in size, but first in importance, comes the delicate little Fruit Rat of russet brown, which Mr. C. W. de Vis, M.A., has identified as a hitherto undescribed species of the genus Uromys. His technical description of the animal (with which he has associated my name) appears in No. 7 of the "Annals of the Queensland Museum." The distinguishing habit which attracted attention in the first instance is the manner in which the mother carries her young, viz., clinging (apparently with tooth and claw) to the haunches.

The blacks confidently assert that kangaroos and wallabies were never known on the Island. This opinion is corroborated by another piece of negative evidence. There are two sets of rock pictures on the Island, in one of which are representations of a bird, a turtle, echidnas, fish, etc, etc. Had marsupials existed, the painter of animal life (he was undoubtedly an old master, for all knowledge of the location of the gallery had passed out of mind, until I was fortunate enough to re-discover it) would hardly have failed to include them among his otherwise comprehensive studies.

Lizards and snakes are fairly plentiful, though the absence of mainland species—the monitor lizard for instance—is apparent even to a superficial observer. The river tortoise occurs, but is very rare.

Avi-Fauna.

The Bird Census of the Island accounts for 128 species, viz.:

Birds of Prey	16
Perchers	38
Picarian	12
Parrots	4
Pigeons and Doves	11
Game	5
Plovers, etc	15
Sea Birds	7
Ibises	2
Herons	8
Cormorants, Gannets, etc. ..	7
Ducks and Divers	3
	128

This list might be strengthened by ten or a dozen species, individuals of which I have not succeeded in identifying—not that non-recognition implies the presence of any uncommon bird, but confessed ignorance on the part of the observer and a fanatical resolution rather to remain in ignorance than purchase knowledge at the cost of the lives of trustful and engaging strangers. No bird has been done to death

even at the instance of exacting science, much less to satisfy curiosity, however eager that vice in respect of the living creature. In my administration of the affairs of the Island I have maintained as strictly as possible the principle of non-interference, and it is most gratifying to be in a position to report that in this attitude the frank support and authority of the Government have been enjoyed. Soon after occupation of the Island I issued an informal proclamation bestowing on birds and plants the fostering care of a benign autocracy. Subsequently I took the pleasure of suggesting to the Government that Dunk Island and certain neighbouring Islands and islets should be gazetted a perpetual sanctuary for birds. In due course this idea was made effective, my appointment as Honorary Ranger being then announced. The islands and islets under this jurisdiction number seventeen. Circumstances prevent the exercise of other than moral restraint in respect of those islands which represent the nethermost parts of the refuge ; but I have reason to believe that the proclamation has not been altogether ignored. Now, however, that many Japanese are engaged in beche-de-mer fishing, I am of opinion that unless fairly frequent visits are made to the Brook Islands, the White Nutmeg Pigeons will be ousted from a favourite breeding resort.

Again the mainland, in accordance with a general principle, shows marked superiority in the number of species. We have no resident parrot, though visitors are numerous at certain seasons ; no magpie or butcher bird to call our own ; no finch, no black cockatoo, no scrub turkey (though that other mound builder, the megapode, is one of the commonest birds of the island), no cassowary, and no wren —to go to the opposite extreme in size—and alack ! no Rifle Bird in shimmering satin and velvet.

Ocean Fauna.

Dugong are frequently seen, and four species of turtle frequent these waters, though the last mentioned has escaped my personal observation —Green, Hawksbill, Loggerhead, and Luth (or Leathery-backed).

Crocodiles do, on the rarest of occasions, venture across from mainland rivers and creeks, but make no long tarrying.

Fish are exceptionally plentiful and rich in variety, while the teeming life of the Coral Reefs is ever a source of wonder, admiration and perplexity. Perhaps I ought to dwell with more of explicitness on this attractive theme ; but does it not evidence a certain kind of valor when an amateur observer hesitates before venturing into touch with a monster, engaging and protean, yet so colossal that those having at command the best equipments of science cannot be quite sure of holding their ground before it ?

Near Neighbours.

Attendant upon Dunk Island are four satellites and eight other islands and islets—the nearest within a few minutes' walk at low water spring tides, the furthest eight miles to the south. Beyond this group is Goold Island, with its attendant Garden Island, and the Brook Group (five) to the east, with lofty Hinchinbrook—the dominant feature of one of the grandest scenes on the east coast of Australia.

The original titles of the neighbouring islands with their present day substitutes are :

Satellites of Dunk Island : Purtaboi (Mound Islet), Mung-um-gnackum, Kumboola, Woln-garin.

Family Group : Timana (Thorpe), Bedarra (Richards), Kumboo (Wheeler), Tool-ghar (Coombe), Bud-joo (Smith), Kurambah (Bowden) Koolah (Hodson).

Not one of these islands has any area of fertile land, though the indigenous vegetation is exceedingly rampant.

Population and Productions

And what, it may be asked, is the population of this insular garden, with its ideal climate, generous rainfall, fertile soil, sumptuous vegetation ; its freedom from all noxious animals save snakes, from which the original Garden of Eden was not alas ! exempt ; its confiding unreflecting birds and its encompassing sea beneficent with fish and dugong and turtle, and romantic with coral and all the wonders of the tepid waters of the tropics ? And in what respects, and to what extent does it contribute out of its super-abundance to the needs of less favoured portions of the Commonwealth ?

" See ! how plain a tale shall put you down." Was ever answer so pat or paltry. Population, three ; Productions, nil. In regard to population it was not always so. Cook mentions having seen on one of the islands constituting what is now known as the Family Group " about thirty natives, men, women, and children, all standing together, and looking with great attention at the ship." A pioneer, who visited Dunk Island 40 years ago, estimates the then population at about 400 ; another was astonished at the large fleet of bark canoes the islanders maintained. The population floated from island to island as far south as Hinchinbrook, but does not appear to have voyaged north, or to have had much communication with the mainland. As far as I have been able to ascertain there were more terms in common between the natives of Dunk Island and those of the far end of Hinchinbrook (40 miles) than with the mainland natives, two and a-half miles removed. There remain alive but five or six of the original inhabitants of the group and of Hinchinbrook but four, if I

am informed aright. Of the natives of Dunk Island, only one with his alien wife and native born child visits his birthplace with any regularity. Three white aliens have all the fair land and the fresh and spicy breezes for their own.

TOM OF DUNK ISLAND.
(Totemic name Kitalbarra.)

Five or six individuals with their sparse offspring therefore represent the remnant of the considerable population which inhabited Hinchinbrook (28 miles long and 12 broad), the Brook Group, Goold Island, the Family Group, and Dunk Island, and this deplorable loss has taken place within 30 years. As far as my knowledge goes, only

one death of a Dunk Island native has occurred within the last ten years. During that period there has been a slight increase among the non-residents, but the extermination of the race at an early date is inevitable. And how slight and trivial their records! A few stone axes, a few fish-hooks of pearl shell, fast-fading rock-pictures—and naught else.

CONCLUSION.

Personally, I like to dwell on the future of Dunk Island as not the least conspicuous item in a great insular national park, the area of which would embrace Hinchinbrook and all the intermediate isles—a park not to be improved by formal walks or set in order to straight lines or lopped and trimmed according to the principles of horticultural art, but just a wilderness—its primitive features preserved; its excesses unrestrained; its waywardnesses unapologised for. In such a wilderness the generations to come might wander, noting every detail—except in regard to original population—as it was in Cook's day and for centuries before.

At least of Dunk Island it may be said, that as it is too small and too dainty a spot to be devoted to large practical purposes, its exceptional gift of beauty need not necessarily be fatal. But whatsoever be its future I am conscious that these ecstasies have been toned down to the degree of wholesomeness because of zealous consideration for the sentiments of those who know it not. "The best part of our appreciation has no language"—a panegyric has been left unsaid.

References:—"The Voyages of Captain James Cook Round the World," "Narrative of the Voyage of H.M.S. Rattlesnake," "Narrative of a Survey of the Intertropical and Western Coasts of Australia (1818 to 1822)" by Captain Philip P. King, "The Queensland Flora," by F. Manson Bailey, F.L.S., "Annals of the Queensland Museum, No. 7."

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† A moment's reflection disposes of a persistent popular error (unhaply repeated in books issued under the authority of the State) regarding the Palm Islands—12 miles to the south of Hinchinbrook. This group is erroneously said to have been named by Captain Cook for the reason that its discovery took place on Palm Sunday. "The Sunday next before Easter" of 1770 occurred on 8th April—eleven days before Cook obtained his first glimpse of the continent of Australia. At daybreak on 7th June following, the Endeavour, having the day previous passed Cape Cleveland and Magnetic Island, was abreast of a group of islands, one of which "what had the appearance of cocoa-nut trees" were seen. Ever eager for the well-being of his ship's company, Cook sent Lieut. Hicks, and with him went Mr. Banks and Dr. Solander, "to see what refreshments could be procured" while he kept standing in for the island with the ship. They returned "with an account that what had been taken for cocoa-nut trees, were a small kind of cabbage palm." These were,

doubtless, what are known as the Alexandra palm. In the addition of Cook's voyages available the actual naming of the islands is not chronicled ; but I am given to understand that a record occurs in the journal kept by Lieut. Hicks to the effect that in the presence of the palms the name originated.

Confusion has also arisen, and may again occur, as to the origin of the title of Goold Island, which (the spelling being compliantly amended) is almost universally associated with John Gould, the famous ornithologist. The name however, was bestowed by then Captain Philip P. King on 19th June, 1818, at which date the author of "Birds of Australia" was but fifteen years old and quite unknown to fame.

ABORIGINAL NAVIGATION.*

By R. H. MATHEWS, L.S.

In the following pages I shall endeavour to briefly define the wide geographic range of the primitive kind of navigation practised among the Aborigines of Australia. An attempt will also be made to give a short description of the rudely constructed crafts employed by these people in moving about upon the water.

The subject can be better elucidated by dividing it under two heads —Canoes and Rafts. As I have travelled over the whole of New South Wales, the greater part of Victoria, and the southern portion of Queensland and South Australia, I shall be able to speak from my own personal observations in regard to them. In those regions of Australia in which I have not gathered details personally or through capable correspondents respecting the canoes and rafts, extracts will be made from the works published by early explorers, navigators and others, who had opportunities of doing so.

I shall commence with the canoes and rafts used in New South Wales and Victoria, being the most southern parts of the Australian continent. I shall then go northwards into Queensland and continue through that State to Cape York and the Gulf of Carpentaria. The sailing craft of the Northern Territory and South Australia will next be described. Then will follow the methods of navigation employed by the aborigines of Western Australia. Lastly, a brief reference will be made to the rafts used by the Tasmanians.

The most useful of Australian crafts is the bark canoe. In New South Wales and Victoria, one sheet of bark is used. In south-eastern Queensland, at Port Essington in the Northern Territory, and on the Lower Murray river in South Australia, canoes were likewise made of a single sheet of bark. In certain northern portions of Queensland, as well as in the Northern Territory, the natives employed more than one piece of bark for this purpose, and it is noteworthy that such crafts are more elaborate in their manufacture than those in use in the more southern parts of Australia, a fact which might suggest foreign influence, such as that of the Malays, at some comparatively recent period.

Capt. M. Flinders, speaking of the natives of Calydon Bay, on the western coast of the Gulf of Carpentaria, says: " It is probable they have bark canoes, though none were seen, for several trees were found stripped as if for that purpose ; yet when Bungaree made them

*Read before the Royal Geographical Society of Australasia, Queensland, une 25th, 1908.

a present of the canoe brought from Blue Mud Bay, they expressed very little pleasure at the gift, and did not seem to know how to repair it."[1] Perhaps the Calydon Bay natives used the single-sheet canoe and were unacquainted with the making of canoes by sewing two or more pieces of bark together, such as the Blue Mud Bay vessel.

When we turn to the Rafts of our aborigines we find that they are much the same in the general principles of construction in all regions of Australia and Tasmania, where they have been reported, and the means of propulsion are substantially the same. It is also seen that rafts were employed in the same districts or side by side with canoes, except in Western Australia and Tasmania, where the latter were not in vogue.

Generally speaking, the raft affords but little protection from the water, which rises freely between the logs, but this defect is of little consequence to the rude navigators, or to their scanty and uninjurable freight. It is perhaps unnecessary to state that in all the Australian canoes and rafts which I have seen, as well as in those described by others, there is nothing to indicate the faintest notion of the use of a sail. The canoe, or its substitute the raft, is a static device, and not a dynamic mechanism.

In perusing the works of navigators and explorers in some other countries, I have not yet found any mention of canoes made from a single sheet of bark, but canoes made from two, three or more pieces have been observed in other parts of the world. The use of rafts, however, has been known among various primitive peoples far and wide over the earth, some of them not differing very much from rafts found in Australia.

Mr. Edward Palmer, in his description of canoes in Northern Queensland herein quoted, says, "The inner bark is always made to be the outside of the canoe."[2] Lieut. J. Henderson, in referring to some aboriginal customs in New South Wales, says: "The native strips a long sheet of bark from a stringy-bark tree. . . . . The outside of the bark forms the outside of the canoe."[3]

In all the canoes which have come under my own observation, no matter what kind of tree they were stripped from, the rough or outer side of the bark was on the outside of the vessel. When the bark forming the canoe has been taken from a bent tree, the ends are consequently turned up, and it would be impossible to turn such a vessel inside out without splitting or cracking the bark at one or both

(1) Voyage to Terra Australis, (London, 1814), vol. ii., p. 213.

(2) Journ. Anthrop. Inst., London, vol. xiii., p. 288.

(3) Excursions and Adventures in New South Wales (London, 1851), vol. ii., p. 153.

ends, thus seriously damaging the vessel. I can speak from experience on this point, because I have made bark canoes in my youth. If the sheet of bark were stripped from a straight tree, it could be turned inside out, if there were any reason for doing so.

Although the canoe is more serviceable for many purposes than the raft, yet the latter possesses the advantage that it is not so subject to damage by accident or exposure to the sun. Bumping against a sharp rock or other obstruction may cause an injury to one of the logs or bundles of which it is made, without interfering seriously with the buoyancy of the rest of the raft. Such a mishap to a canoe might damage it beyond repair or even cause it to sink. Perhaps this is the reason that rafts are so universally used.

I would like to offer a few remarks on certain statements made by two of the early writers on the New South Wales aborigines. Dr. George Bennett, when travelling from Cullen Bullen to Dabee in the Rylstone district, saw some kurrajong trees and makes the following remark : "The wood of the kurrajong tree is used by the aborigines for boats and canoes."[1] Some years ago I was all through that district discharging my duties as a surveyor, and being aware of Dr. Bennett's statement, I made enquiry from old aborigines if ever they had made canoes out of wood, but they had never heard of such a thing. I also asked white settlers of long standing and their replies were to the same effect. I am of opinion that Dr. Bennett was told by white people that the blacks sometimes used dry logs of kurrajong and other light and buoyant woods as rafts, and that he did not differentiate between these and the real canoe.

Mr. G. F. Angas says : "Their canoes were very rude. To the southward and on the Murray river they are mere pieces of bark tied together at the ends and kept open by means of small bows of wood. Towards the north they have canoes of a more substantial character, formed of the trunks of trees, twelve or fourteen feet long ; they are hollowed out by fire and afterwards trimmed into shape with the *mogo* or stone hatchet."[2] In 1860, I was working amongst stock on the Clarence and Nymboida, two important rivers in northern New South Wales, when the blacks were numerous and I saw them almost every day—most of them quite naked. I frequently crossed streams in bark canoes, but never heard of one cut out of a log of wood. In several parts of New South Wales, however, I have seen canoes made by white men for crossing over rivers at sheep and cattle stations. A large, hollow tree was selected and cut down.

(1) Wanderings in New South Wales (London, 1834), vol. i., p. 115.

(2) Waugh's Australian Almanac for 1858 (Sydney), p. 56.

The rotten interior was burnt out and then cleaned more thoroughly with an axe. The ends were then blocked up by thin wooden slabs, securely nailed and afterwards caulked with rags or wool.

From the vagueness of the statements of both Dr. Bennett and Mr. Angas I feel confident that they never saw log canoes (or dug-outs) in use by the natives, but were misled by the careless reports of white men. It is, of course, possible that the blacks occasionally copied the white man's method of constructing a canoe, after they were supplied with iron tomahawks and axes.

The catamaran and dug-out, used by the aborigines of Cape York Peninsula, Port Darwin, and other northern portions of Australia, will not be included in this Chapter, because I do not consider them of purely Australian origin, but as introductions by the Malays and Papuans. For information regarding these the reader is referred to works on the people of the Malay Archipelago and New Guinea.

I am of opinion that the canoe made from one single sheet of bark is a purely Australian development, because I have not been able to trace its existence in any other country. The tall, clean-stemmed eucalyptus trees of Australia might readily suggest to the native mind the using of the bark for huts and canoes. Owing to the warmth of the climate, the sap is in circulation, either upwards or downwards, during a great proportion of the year, rendering the stripping or removing of the bark from the tree a simple and easy piece of work, even with such a rude implement as a stone axe.

CANOES.

The canoe is a highly valued possession among natives living in the vicinity of rivers or large sheets of deep water. On the Murrumbidgee, Lachlan, Murray, Darling, and other large rivers of New South Wales, the bark of the red gum tree, when available, is used in making canoes, a single sheet of bark being sufficient. Trees with natural curves are chosen, because canoes so obtained do not require so much labour to give them the proper shape. When the bark is stripped from the tree, while it is still soft and pliable, stretchers are placed across it at intervals of a few feet. This is done to prevent the bark from curling, while the sap is in it ; short props of wood are also placed under the stem and stern to keep them from becoming too much depressed by reason of their own weight.

The vessel is then left to season for a week or two, according to the weather, and when properly dry and set it retains its shape. The length of these canoes varies from five or six feet up to as much as twice that length in exceptional cases ; the width being from two to three feet. According to the size of the canoe required so is the tree

selected from which to take the bark. After the lapse of two or three years such a vessel becomes heavy and sodden, and correspondingly unwieldy, when it is found necessary to replace it with a new one.

The paddle for propelling the canoe varies in style in different districts. On the Murrumbidgee and some other places; it consist of a stick about ten or twelve feet long and two or three inches broad at the paddling end. To the other end are attached three sharp prongs about fifteen inches long, the two outside ones having barbs similar to those seen on spears, but less elaborately worked. The prongs are fastened on to the shaft with string and secured with gum which exudes from certain trees, such as the grass-tree, beefwood and others. With one end of this implement the native propels his canoe by striking the water alternately on either side, and with the other end he transfixes such fish as may come in his way. He is aware of the difference between the true and apparent position of the fish under the water, due to refraction, and aims his stroke accordingly. The paddle is made of pine wood if obtainable, or other light timber.

When fishing with a spear as just stated, the native usually stands, but if using a net or in crossing a stream, or when moving from one locality to another, he sits. In that case he uses a short paddle, resembling a tennis racket, or perhaps two such paddles, one for each hand. A small heap of clay, or a thin flat stone imbedded in earth, is placed in the bottom of the canoe between the middle and the stern, upon which a little fire is kept burning, for the two-fold purpose of keeping himself warm and of cooking some of the fish which are caught.

Another important use of the fire is to enable the native to melt the gum which he carries to repair any damage to his fishing spear. When a large fish is struck, some of the prongs may be turned out, or perhaps two or more are pressed together, owing to collision with a bony part of the animal. The fisherman puts these prongs into their right positions again. When the necessary repairs are effected he heats his supply of gum at the fire in the bottom of the canoe, and makes everything fast with it. Gum so heated was also used in repairing leakages in the craft. Still another use of the fire is to protect the occupant against supernatural agencies. A native always carries a fire-brand even when travelling upon the land.

A canoe is seldom required to carry more than two persons, as a man and his wife, or two friends. I have often seen canoes containing women only. Many of the smaller crafts cannot conveniently or safely accommodate more than one person. As these vessels are exposed to the sun or hot winds when not in use, longitudinal cracks appear in the bark, through which the water leaks. Such cracks are caulked

with clay or gum. Grass is sometimes pressed into the crack with a chisel-shaped piece of wood and this is covered over with gum to prevent leaking. When water leaks into a canoe or splashes over the side, it is bailed out with a small bark koolamin carried for the purpose. Not infrequently one of the small bark paddles is hollow on one side and is improvised as a bailer. There is generally a good deal of "pumping" required to keep the frail vessel afloat. Moreover as these canoes have no keel, but are quite round at the bottom, they are very easily overturned.

When the native gets out of his canoe he usually pulls it up on the bank, to ensure it from getting water-logged, especially in tidal water or a running stream. In placid water I have seen a canoe, not subject to leakage, tied to a sapling with a string made of kurrajong or stringy-bark fibre ; the other end of the string, or "painter," was fastened to the front end of the vessel. When fishing in shallow water or near the margin, a spear or a yamstick is sometimes stuck into the muddy bottom, and the canoe fastened to it with a cord.

Stringybark and the bark of what is commonly known as the grey box tree are often used in districts where they abound. Although trees with a natural bend are preferred, they are not always available and the bark of straighter trees has to be employed. After the sheet is stripped from the tree, the ends are thinned by chopping away a little of the outer rough bark for about a foot back from the extremities, leaving only the pliable inner bark, which was heated over a smoky fire. The ends of the sheet, consisting of this prepared inner bark, were then puckered lengthwise and squeezed together, while still hot and bound round with strong string manufactured from the fibre of the kurrajong or stringybark. This binding was sometimes accomplished with a small, tough vine found growing in the scrubs. Strong cords made of tough, fibrous bark were tied across the vessel from edge to edge at two or three places to keep it from expanding outwards ; and the same number of bent stretchers or ribs were placed within the canoe to keep the sides from collapsing inwards. Instead of the ribs, a cross-piece was frequently inserted from side to side, to keep the vessel in shape. In addition to the binding, some wet clay was sometimes pressed into the ends of the canoe to make it all the more water-tight.

The puckering or plaiting of the bark at the end not only gathers it in horizontally, but also has the effect of curving it upwards, so that when the lashing is completed and the vessel launched, the end is slightly higher than the sides of the canoe, and is above the water-line. It was often only necessary to fold and tie the sheet of bark at one end—the other end having an upward curve which was either

in it when stripped from the tree, or was improved by turning it up and letting it dry in that position. In such a case, the bound end always formed the stern of the craft.

The thick, stiff bark of the red gum-tree cannot be gathered and tied at the ends ; if dressed down to make it thin, it would break in the plaiting or folding unless great care were exercised. Stringybark or box bark is tougher and readily lends itself to bending when warmed or steamed over a smoky fire while it is green.

On the Namoi, Macquarie, Barwon, and other rivers of New South Wales, I have seen both ends of the canoe stopped up with firm clay, which was puddled and applied in a moist state and then allowed to dry. The clay was occasionally mixed with grass or reeds, or with small tough twigs. Sometimes both ends of the canoe were blocked up with clay—sometimes only one end if the other had a natural curve upwards.

It should be explained that in stripping the bark from any kind of tree for any description of canoe, it is taken off the tree in the form of an elongated oval—that is, the top and bottom of the sheet are not cut straight across the bole of the tree, but in the shape of a horse-shoe, or the upper end of a cone.

When a native wishes to remove his canoe from the river over some intervening land to a lagoon, or from one lagoon to another, he carries it on his head. Paddle, weapons, and other belongings or spare food, may be brought along inside the canoe. If the craft be large, or is weighted with such " freight " as just described, two persons join in the portage, one at each end—generally the blackfellow and his gin.

If the owner of a canoe goes back into the hinterland where there are no lagoons or sheets of water, he hides his vessel in a patch of scrub near the river bank and covers it with bushes to protect it from the sun till his return.

I have already said that owing to the primitive structure of these frail crafts they capsize very readily. The occupant has to exercise continual care to prevent overturning. On this account when entering the canoe the native steps lightly into the middle of it, balancing his body like a man walking on a tight rope. If he intends to remain standing, he strikes the water first on one side and then on the other with a long pole. If the water is shallow he places the lower end of the pole on the bottom and shoves his craft along.

If he considers a sitting posture would suit his purpose best, he squats down with his heels doubled under him and his knees resting against the sides of the canoe. He catches his paddling pole by the centre and dips in it the water alternately on each side. Or perhaps he improvises his wommera or a spear as a paddle, striking the water

on alternate sides. The use of small bark paddles has been explained in an earlier paragraph. Sometimes the man kneels on a pad of leaves or grass or soft bark, which he has placed on the bottom of the vessel for that purpose. If two persons are in the canoe, one sits as near the stern as possible without the water slopping in. The other person sits or stands well forward, but leaving the prow a little higher out of the water than the stern. The fire already referred to is between the two. If there is a ripple on the water, caused by the wind or the current, both the voyagers sway their bodies slightly, according to the rolling of the vessel, so as to avert its upsetting. The vessel is steered athwart the direction of the wind or stream, and is borne over the crest of the waves sidewise, recalling the easy movement of a seagull. If the canoe has but one occupant, he sits or stands in the centre, with the fire between him and the stern. Personal effects, fish and other impedimenta, are distributed in the craft in such manner as not to disturb the balance. But as a rule, nothing unnecessary is carried.

When two men, or a man and his wife, go out fishing in a canoe at night, one of them waves a burning stick held in the hand, the blaze of which attracts the fish, which are then speared by the man on the look out for them. If the fishing was carried on in deep water close to the shore, a fire was lit on the land near the edge of the water, to allure the fish to the spot. In fishing operations, the person sitting in the rear of the canoe does most of the paddling, leaving the other free to watch for the fish.

Bark cannot be stripped from trees at all times, but only at those seasons of the year when the sap is in circulation, either going up or coming down the bole. But there is considerable irregularity in the time when this occurs. In good or normal years the sap ascends in the early spring; in times of drought it is much later. But even in the same forest under similar conditions of weather, the sap circulates in some trees more freely than in others, even when of the same species; young healthy trees and those growing in favourable localities being earlier than the rest. On this account, when a blackfellow has found a tree from which a suitable sheet of bark could be obtained for a canoe, he first of all cuts with his tomahawk through the bark into the wood in two places, one about a handbreadth immediately below and parallel with the other, each cut being horizontal and about three inches long. He then makes a vertical cut at each side of those already made, and tries to prise off the bark with his tomahawk or piece of sharpened wood. If this small section of bark comes off easily, it shows that the sap is circulating and the man proceeds with stripping off the material for his canoe; if not, he tries other trees in the same way.

It may be stated that a tree whose bole is free from knots, grub-holes, or other blemishes is always looked for.

Having given the results of my own personal investigations, I will now make a few short extracts from the works of other authors in the early days of the occupation of Australia. These extracts will be confined to those parts of the continent which are not already touched upon in this work.

J. Macgillivray describes some aboriginal canoes which he saw in Rockingham Bay, on the north-east coast of Queensland, where the town of Cardwell has since been built. He says: "Their canoes are very rudely constructed of a single sheet of bark of the gum tree, brought together at the ends and secured by stitching. The sitter squats down with his legs doubled under him, and uses a small, square piece of bark in each hand as paddles, with one of which he also bails the water out, by dexterously scooping it up from behind him. . . . There were eight canoes, four of which carried two men, and the others one man each."[1]

Capt. P. P. King refers to canoes in the same locality: "The canoes were not more than five feet long and generally too small for two people. Two small strips of bark, five or six inches square, serve the double purpose of paddling and for bailing the water out, which they are constantly obliged to do to prevent their canoe from sinking. In shoal waters the paddles are superseded by a pole, by which this fragile barque is propelled."[2]

Speaking of the natives of Cape York Peninsula and the Gulf of Carpentaria, Mr. E. Palmer says: "Canoes are only found among the coast tribes, where they are much used in the calm waters inside the Barrier Reef and among the islands of the Gulf of Carpentaria. They are formed of three separate sheets of bark, cleaned of the outer rough covering, pointed at each end, and bored with holes along the edge for sewing together. One sheet forms the bottom, the other two making the sides and the ends. A piece of filling or roll of grass is sewn in between the edges, to strengthen and fill up the seams. The inner bark is always made to be the outside of the canoe. A rim is sewn of tough vines around the gunwale to add stiffness and strength, while a cord across the centre keeps it from spreading, and a piece of wood at either end to keep it apart. Such a canoe is capable of carrying four or five persons and can be used in a moderate sea.

(1) Narrative of the Voyage of H. M. S. "Rattlesnake," in 1846 to 1850 (London, 1852), vol. i., p. 81.

(2) Narrative of a Survey of the Intertropical Western Coasts of Australia (London, 1827), vol. i., p. 202.

The blacks bail the water out with a large shell, and broad paddles four feet long are used."[1]

Capt. M. Flinders mentions a canoe he saw at Blue Mud Bay, off the mouth of the Walker River, on the western shore of the Gulf of Carpentaria, in the Northern Territory: "The canoe was of bark, but not of one piece as at Port Jackson. It consisted of two pieces, sewed together lengthwise, with the seam on one side; the two ends were also sewn up and made tight with gum. Along each gunwale was lashed a small pole; and these were spanned together in five places with creeping vines, to preserve the shape and strengthen the canoe. Its length was thirteen and a half feet and the breadth two and a half feet, and it seemed capable of carrying six people, being larger than those at Port Jackson."[2]

Capt. P. P. King found canoes at Port Essington, Northern Territory, one of which he describes: "The canoe measured eighteen feet in length by two feet in width and would easily hold eight persons. The sides were supported by two poles fastened to the gunwale by strips of a climbing plant, *flagellaria indica*, that grows abundantly hereabouts, and with which also the ends of the canoe were neatly and even tastefully joined. The poles were spanned together on either side by ropes constructed of strips of bark. The canoe was made of one sheet of bark. But in the bottom, within it, short pieces were placed crosswise in order to preserve its shape and increase the strength. The canoe was secured to the beach by a small rope.[3]

Mr. W. H. Willshire reports seeing a blackfellow and his lubra (wife) crossing a large lagoon, dotted with red lilies, in a very frail canoe.[4] This was in the valley of the Victoria river, Northern Territory, and although he does not mention the exact locality, the context shows that it was somewhere between the Gregory and the Gordon, tributaries of that river. The material of which the canoe was made is not stated

Rev. George Taplin, in describing the customs of the Narrinyeri tribe at Lake Alexandrina, South Australia, says: "They make canoes of the bark of the red gum tree, stripped off in large sheets. These sheets are laid on the ground and the sides and ends encouraged to curl up to the proper shape while it is drying by being tied with cords strained from side to side and end to end, and stones are placed in the bottom. But these bark canoes, although handy when new, soon

(1) Journ. Anthrop. Inst., vol. xiii., p. 288.

(2) Voyage to Terra Australis (London, 1814), vol. ii., p. 198.

(3) Narrative of a Survey of the Intertropical Western Coasts of Australia, London, 1827), vol. i., pp. 89-90.

(4) The Land of the Dawning (Adelaide, 1896), pp. 48-49.

get sodden and break. They seldom last more than twelve months. . . . . . A man will stand in a canoe silently watching with uplifted spear, until a fish comes beneath, when the weapon is darted down on its back, and it is lifted transfixed from the water."[1]

On the Lower Murray, above Lake Alexandrina, Mr. T. H. James "found a canoe made fast to a stake driven into the mud. It consisted of a single sheet of thin bark. Towards the stern was the remains of a fire."[2]

I have been in communication with a large number of station owners, miners and others in Western Australia respecting the customs of the aborigines generally, but I have not yet been able to obtain any information as to the use of canoes in that State. Mr. Thomas Muir, of Deeside Station is a very old resident of Western Australia, and is well acquainted with the coast from Perth to Eucla. He informs me he is quite certain that no canoes were used by the natives of that region.

Dr. Scott Nind was medical officer at King George's Sound, now called Albany, Western Australia, from 1827 to 1829. In describing the customs of the natives of that district he says they had no canoes.[3]

Lieut.-Col. Collins, speaking of the natives of the Derwent river, Tasmania, says: "No canoes were ever seen, nor any tree so barked as to answer that purpose; and yet all the islands in Frederick Henry Bay had evidently been visited." These islands were no doubt visited by means of rafts and floats, which we shall see presently were used by the Tasmanians.[4]

RAFTS AND FLOATS.

On most of the larger rivers of Australia, as well as in the bays on the sea-coast, the use of rafts or floats was known to the aborigines. On the Shoalhaven and other rivers on the south-east coast of New South Wales, the stem of the cabbage-tree, a light and pithy wood, was employed for making rafts. Generally two, but occasionally three, dry logs of this tree, from fifteen to twenty feet in length, selected for straightness and uniformity in size, were lashed together with ropes made of stringybark fibre or vines, and were capable of supporting the weight of one or two persons in crossing stretches of water or in going from place to place along the river. A bunch of the leaves of the tree were fastened on top as a sitting place. They were propelled by means of a paddle, similar to those used for canoes.

(1) The Narrinyeri Tribe (Adelaide, 1874), pp. 29-30.

(2) Six Months in South Australia (London, 1838), p. 232.

(3) Journ. Roy. Geog. Soc., London, vol. i., p. 32.

(4) Account of the English Colony in New South Wales (London, 1802), vol. ii., p. 188.

Sometimes the native stood, with a foot on each log and used a long pole with which he struck the water on each side in succession. In shallow water he pushed his craft along by pressing the pole on the bottom. I have occasionally seen youths using a single dry log, on which they sat straddle-legs with their feet in the water, paddling along with their hands or with a piece of bark. Rafts were similarly made of dried stems of the bungalow tree, three or four being fastened together, with the butts at the same end.

On the Hunter and some other streams of the north-east coast of New South Wales, stems or branches of the kurrajong, another light and buoyant wood, were used instead of the cabbage-tree, and in the same way. On the Lower Lachlan, Murrumbidgee, and Murray rivers, where large reeds grow in abundance, they were used when dry for making rafts, in the following manner. Bundles of these reeds were lashed together with string and then three or four bundles were treated as the logs above described, by fastening them together with stronger ropes. The rafts were used in going out on large sheets of water for the purpose of spearing fish. A place was made of weeds or grass, covered with damp earth, on which a small fire was kept burning. In the Clarence river district I once saw a raft made of the branches of the mangrove tree, which had been cut and allowed to dry in the sun until quite light, when they were bound together so as to support one man, who stood and paddled with a long wooden spear. An old resident of the Manning river, who had roamed about with the blacks a good deal in his youth, told me he had seen dry pine logs used in a similar way.

It was not uncommon for a native to use a dry buoyant log, alongside of which he swam, resting one arm at a time by throwing it over the log. I have also occasionally seen natives swimming alongside one of their rafts, shoving them through the water from one side of a lagoon to the other. Sometimes a piece of bark was laid flat on top of the raft, upon which the navigators placed their belongings.

The late Mr. Edward Palmer, who once owned some large stations in North Queensland, told me he had frequently seen rafts in use on the Mitchell, Palmer, and Saxby rivers, which flow into the Gulf of Carpentaria. They were made of dry logs of a very light wood known in that district as the quandong tree, fastened together by means of cross-pieces and vines. He said he also saw rafts consisting of dried mangrove branches, or bundles of palm-fronds, or other buoyant material. They were mostly wide at one end and smaller at the other. In some instances the native lay full length on the raft and propelled it with his hands.

One of my sons resided some years in the northern parts of Queensland and was well acquainted with the Burdekin and Johnston rivers, on both of which he occasionally saw natives using rafts. When at Normanton in the Gulf Country, the aborigines told him that canoes and rafts were in use among them. From what my son said I felt satisfied that the main features of the construction of the rafts were similar to what I had myself seen elsewhere.

It will be interesting to briefly mention a few of the rafts reported by early writers in portions of Australia not reached by my own investigations, in order to show their geographic distribution.

Allen's Island is close to the south-western shore of the Gulf of Carpentaria and belongs to the State of Queensland. It is situated between Pt. Parker on the mainland and Bentinck Island, and is one of the Wellesley group. Capt. M. Flinders thus reports some rafts which were seen by him on Allen's Island : " The rafts consisted of some straight branches of mangrove, very much dried, and lashed together in two places with the largest ends one way, so as to make a broad part, and the smaller ends closing to a point. Near the broad end was a bunch of grass, where the man sits to paddle ; but the raft, with his weight alone, must swim very deep, and indeed I should have scarcely supposed it could float at all. Upon one of the rafts was a short net which from the size of the meshes was probably intended to catch turtle ; upon another raft was a young shark."[1]

Capt. J. L. Stokes describes a raft which he saw near Bathurst Island, in the extreme north of the Northern Territory. " It was formed of the dead trunk of a mangrove tree, with three distinct stems growing from one root, about eighteen feet long and four and a half wide. The roots at one end closely entwined, as is the habit of that tree, formed a sufficient bulwark at the stem, while an elbow in the centre of the trunk served the same purpose at the stern. A platform of small poles, well covered with dry grass, gave sufficient flooring to this crude craft."[2] Capt. Stokes saw a man paddling a raft with a short spear, sharp at each end, and struck the water alternately on either side."

At Paterson Bay, near Port Darwin, Northern Territory, Capt. Stokes observed a raft on which were two women with several children, whilst four or five men were swimming alongside, towing and supporting themselves by means of a log of wood across their chest. The raft itself was quite a rude affair, being formed of small bundles

(1) A Voyage to Terra Australis (London, 1814), vol. ii., p. 137.

(2) Discoveries in Australia, i., pp. 173 and 175.

of wood lashed together, without any shape or form, quite different from any we had seen before."[1]

At Hanover Bay, on the north-west coast of Western Australia, into which the Prince Regent river empties, Capt. P. P. King reports a raft. "It consisted of five mangrove stems lashed together to a frame of smaller wood. These rafts are buoyant enough to carry two natives, besides their spears and baskets."[2]

On the north-west coast of Western Australia, Capt. J. L. Stokes found a raft on the south side of Roe's Group. "It was formed of nine small poles pegged together and measured ten feet in length by four in breadth ; the greatest diameter of the largest pole was three inches. All the poles were of the palm-tree, a wood so light that one man could carry the whole affair with ease. By it there was a very rude double-bladed paddle."[3]

When exploring in the vicinity of Mermaid Strait and Nickol Bay, on the north-west coast of Western Australia in 1861, Mr. F. T. Gregory states : "Our ship was visited by two natives, who had paddled off on logs of wood, shaped like canoes, not hollowed but very buoyant, about seven feet long and one foot thick, which they propelled with their hands only—their legs resting on a little rail made of small sticks driven in on each side. . . . . It was not far from this spot that Capt. P. P. King had a visit from natives similarly equipped more than forty years ago."[4] Capt. P. P. King says that at Rosemary Island he saw three natives seated each on a log of wood, which he propelled through the water by paddling with his hands.[5] This is the incident referred to by Mr. Gregory.

Mr. Robert Austin, during an exploring expedition in Western Australia, saw a raft at the south entrance of the Gascoyne river into the sea. It consisted of a light log of white wood, eleven feet long and ten inches in diameter. As the raft was found among some drift timber, Mr. Austin inferred that it had been brought down the Gascoyne from the interior by floods. This raft was presented to the public museum at Perth, Western Australia.[6]

Mr. E. T. Hardman, the geologist attached to the Kimberley Surveying Expedition, Western Australia, in 1883-4, contributed a paper

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(1) Discoveries in Australia, vol. ii., pp. 15-16.

(2) Narrative of a Survey of the Intertropical Western Coasts of Australia (London, 1827), vol. ii. p. 69.

(3) Discoveries in Australia (London, 1846), vol. i., p. 11[illegible].

(4) Journals of Australian Explorations, p. 156.

(5) *Op. cit.* vol. i., p. 38.

(6) Journ. Roy. Geog. Soc. London, vol. xxv[illegible]. p. 27[illegible]

to the Royal Irish Academy[1] in which he states : " Spears are generally used in taking fish. The native constructs a rude raft of logs, on which he ventures into a deep pool where fish are plenty. He has in one hand a piece of twine to which is attached a bait. The fish, attracted by this comes up to nibble at it and while its attention is engaged by the lure, the native promptly spears it."

From the mouth of the Gascoyne river southerly to King George's Sound and onward easterly to Port Lincoln I have been unable to learn that rafts were ever in use among the natives. The present aborigines, as well as the early white settlers inform my correspondents that there were neither canoes nor rafts along that stretch of coast. I am also unable to find a report of the use of either of these forms of craft in the works of any other author. I hope that some one who has opportunities will make further inquiries.

Mr. R. B. Smyth, speaking of navigation among the natives of Tasmania, gives the following quotation from Mr. Dove's work : " The contiguous islands of the Straits were frequently visited by the tribes located on the northern coasts of Tasmania. A species of bark or decayed wood, whose specific gravity appears to be similar to that of cork, provided them with the means of constructing canoes (rafts). The beams or logs were fastened together by the help of rushes or thongs of skin. These canoes resembled, both in shape and mode by which they were impelled and steered, the more elegant models in use among the Indians of America. Their peculiar buoyancy secured them effectually against the usual hazards of the sea."[2]

Lieut. Jeffreys, referring to the aboriginal inhabitants of Tasmania, says : " When, during their excursions in the autumn, which were supposed to be from west to east, and in the spring from east to west, they came to an arm of the sea, or a large river, or a lake, they made a kind of raft, which was formed of the trunks of two trees, about thirty feet in length and laid parallel to one another at a distance of five or six feet. The logs were kept together by four or five lesser pieces of wood, laid across at the ends and fastened by slips of tough bark. In the middle was a cross timber of considerable thickness, and the whole was interwoven with a kind of wicker-work. This flat and completely open raft, or rather float, was made to skim along the surface of the water by means of paddles, with amazing rapidity and safety. The natives were frequently seen on them near the southern mouth of the Derwent river, between Bruni Island and the mainland, where the rafts were often found deserted by their owners."[3]

(1) Proc. Roy. Irish Acad., Series 3. vol. i., p. 62.

(2) The Aborigines of Victoria, vol. ii., p. 401.

(3) Van Dieman's Land (London, 1820), pp. 127-128.

Speaking of the aborigines of Macquarie Harbour, on the western coast of Tasmania, Mr. J. Backhouse says : " They cross the mouth of the harbour on floats in the form of a boat, made of bundles of the paper-like bark of the swamp tea-tree, lashed side by side by means of tough grass. On these three or four persons are placed and one swims on each side, holding it with one hand."[1]

Rev. J. West speaks of a raft found by La Billardiere in Adventure Bay, Bruni Island, on the southern coast of Tasmania. It was made of pieces of bark and held together by cords made of grass and assumed the appearance of meshes worked in the form of a pentagon.[2]

An interesting feature in connection with Australian rafts and floats, revealed in the preceding pages, consists in the fact that at Paterson Bay near the extreme north of the Northern Territory, rafts were sometimes towed by men swimming alongside. At Macquarie Harbour, on the western coast of Tasmania, a man swam on each side of the raft, towing it with one hand each. In the Northern Territory, as well as in Tasmania, rafts were also propelled by paddles. In both the localities mentioned we have seen that some rafts were made of bundles of wood or bark lashed together, whilst others consisted of two or three logs of wood on which cross pieces were fastened. These places are separated by about thirty degrees of latitude, or eighteen hundred geographical miles.

(1) Narrative of a Visit to the Australian Colonies (London, 1843), p. 58

(2) History of Tasmania (Launceston, 1852), vol. ii., p. 77.a

PROCEEDINGS

OF THE

Royal Geographical Society of Australasia,

QUEENSLAND.

ANNUAL GENERAL MEETING,

JULY 30TH, 1908.

The Vice-President, Hon. Sir Arthur Morgan, Kt., M.L.C., Lieut.-Governor, in the chair.

The attendance was large and representative.

The minutes of the previous monthly meeting were taken as read and duly confirmed.

The Rev. Hugh Simmons was elected an ordinary member of the Society.

The Hon. Secretary and Treasurer (Dr. J. P. Thomson) read the annual report of the Council, and submitted the usual financial statement, both of which were adopted on the motion of Lieut.-Colonel Irving and Mr. L. F. Schoenheimer.

The following officers and Council were then elected:—

Patron:

His Excellency the Rt. Hon. Lord Chelmsford, K.C.M.G.

Vice-President:

The Hon. Sir Arthur Morgan, Kt., M.L.C.

Hon. Secretary and Treasurer:

J. P. Thomson, LL.D., Hon F.R.S.G.S.

Other Members of Council:

Lieut.-Col. James Irving, M.R.C.V.S.L., etc., Hon. F. T. Brentnall, M.L.C., L. F. Schoenheimer, Esq., J.P., George Fox, Esq., M.L.A., James Stodart, Esq., M.L.A., Hon. William Kidston, M.L.A., E. C. Barton, Esq., M.L.A., Allan A. Spowers, Esq., J.P., George Phillips, Esq., C.E., E. J. T. Barton, Esq.

Sir Arthur Morgan said he was called upon to perform the most pleasant duty of the evening. It was the presentation, on behalf of the Society, of a purse of sovereigns to Mr. Arthur Thomson, the eldest son of their worthy Hon. Secretary and Treasurer, on the eve of his departure for Canada, to prosecute his studies at Queen's University, Ontario. The young recipient, Sir Arthur Morgan explained, had rendered much useful and meritorious service to the Society in helping his father with the routine work, and the members had spontaneously decided to give him this recognition of his unselfish devotion to their interests. They all hoped he would go forth assured of their good wishes for his success, and return laden with honours which would be gratifying to his parents and creditable to himself and the State he went from. He, Sir Arthur, had great pleasure in presenting him with a purse of sovereigns accompanied by an address expressive of the best sentiments of the members of the Society as follows:—

Royal Geographical Society of Australasia, Queensland.

Brisbane, July 30th, 1908.

To Mr. Arthur G. P. Thomson.

Dear Sir,—The members of the Royal Geographical Society of Australasia (Queensland), having learned that you are leaving shortly for Canada, to prosecute your studies at Queen's University, Ontario, take this opportunity of marking their sense of the untiring labours of your father (Dr. James Park Thomson, LL.D., Hon. F.R.S.G.S., Honorary Secretary and Treasurer of the Society) in the cause of geographical science, and their appreciation of the ready assistance you have always rendered at the monthly and annual meetings of the Society, and in the incidental clerical work.

The Council, in asking you to accept the accompanying purse of sovereigns, desire, on behalf of the subscribers and members generally, to wish you the fullest measure of success in your career. May you enjoy all the blessings of health and happiness, and ever make it your aim worthily to represent this, your native land.

Very truly yours,

(Signed) ARTHUR MORGAN, Vice-President.
JAMES IRVING, M.R.C.V.S.L., Councillor.
L. F. SCHOENHEIMER, do.
FREDK. T. BRENTNALL, do.
JAS. STODART, do.

Dr. Thomson, on behalf of his son, warmly returned thanks to the donors for the handsome presentation.

REPORT OF COUNCIL.

23RD SESSION, 1907-1908.

In summarising the work of the past session brought to a close on the 30th June, 1908, the Council has pleasure in submitting to the Fellows and Members the Twenty-Third Annual Report on the operations of the Society during the preceding financial year. In so doing, it is exceptionally gratifying and encouraging to the officers and Council, whose services are cheerfully dedicated to the active work of the Society, to report a satisfactory increase of 51 new members, including three ladies and three life members, most of whom are geographically distributed over the whole of the State, one in New Guinea, two in South Africa, and all being representatives of wide and important interests in the intellectual and industrial life of the country. And the Council confidently hopes that as the objects of the Society and the exceptionally wide and liberal privileges of membership become more generally known and understood, the accessions to the membership roll will yearly increase until every centre of population in the State will be fully represented. But while alluding, with satisfaction, to this unusually large increase of members, it is deeply to be regretted that death has removed five greatly valued supporters, whose names were well and favourably known in Southern and Northern Queensland. Of these, the oldest in point of years and perhaps also the one longest associated with the public life of the State, was the Hon. F. H. Holberton, of Toowoomba, who had been for a long time a member of the Society. Next, there was the Rev. Father W. M. Walsh, of St. Joseph's, Townsville, one of the earliest Life Members, upon whom the Diploma of Fellowship was conferred some time ago, and whose deep and wide sympathies with the objects of the Society were greatly encouraging and much appreciated. In the death of Mr. A. C. Haldane, who occupied the position of Police Magistrate at Gympie, the Society has lost a valuable supporter and the State a loyal and efficient public servant. Mr. F. A. Outridge, whom death has taken away in the prime of life, was one of those esteemed adherents who joined the Society in the beginning of the session. He was for several years the active managing director of the well and favourably known city printing company which bears his family name, and had long been identified with the work of turning out our "Journal." His sudden and unexpected demise has removed from our midst a worthy citizen and greatly beloved friend. Mr. G. H. Cottell, whose untimely death occurred only a

few weeks ago, was one of the latest accessions to our roll of greatly valued members, having been elected only a few months back. His premature removal from our ranks in the prime of life through a boating accident on the bar of the Maroochy River, has occasioned a sad bereavement to his wife and young children, and deep sorrow to a large circle of local friends. It is felt that in the decease of these subscribers the Society has sustained a decided loss.

The twenty-second volume of the Society's journal was sent out in the beginning of the last session to members and cognate bodies all the world over, and has been generally welcomed, some of the papers forming its contents having been very favourably noticed in Europe and the United Kingdom. In point of fact, the journal, as a source of reliable information on the geographical and general scientific progress of Queensland, is in great demand, as evidenced by the numerous applications for current and back numbers received yearly from societies and other public institutions at home and abroad. As an instance of this, it may be mentioned that the famous Bodleian Library of Oxford University has become a "subscribing member of the Society," so as to procure the "Journal" regularly. From European and American sources the demand is increasing, and as formerly mentioned, it has been found impossible to respond to the numerous applications for the far back numbers, which are now out of print. Some time ago the Bishop of New Guinea applied specially to the Society for Volume I. and other subsequent numbers published at the beginning, but it was only in one of the Southern book markets that the required copies were procured after much trouble and delay. In issuing the "Journal," it has always been recognised (a) that the members of the Society should be first considered; (b) that all kindred societies and other scientific, public, and educational bodies should receive copies in exchange for their publications. By this system of exchange the knowledge obtained locally has been diffused, while the Society has acquired one of the most valuable and extensive geographical libraries in Australia, and one whose numbers and commercial value are increasing daily. At present about 300 copies of the "Journal" are sent out annually as exchanges to every civilised country in the world, apart altogether from those issued to members of the Society. Geographically considered, these exchanges are distributed over the following countries:—Great Britain and Ireland, Austria, Hungary, Belgium, Denmark, Finland, France, German Empire, Greece, Holland, Italy, Norway, Portugal, Rumania, Russian Empire, Spain, Sweden, Switzerland, China, French Indo-China, India, Japan, Siberia, New South Wales, New Zealand, Queensland, South Australia, Tasmania, Victoria, Cape Colony, Egypt, Natal, Argentine Republic, Bolivia, Canada, Chile, Peru, Colombia, Mexico, United

States of America, and West Indies. The cost of mailing the "Journal" to these places is very considerable, and taken with the postage on the edition sent out to members and on the general correspondence during the year, is one of the heaviest items of current expenditure, amounting to over £47 for the past session. This is no doubt a large sum to pay out of a comparatively limited revenue for one year's postage, and to the uninitiated may seem excessive. But for a society of the kind to carry on its legitimate work properly, with becoming activity, and to maintain its rightful place amongst the kindred, scientific, and literary bodies of the world, the foreign and domestic correspondence must necessarily be extensive, and is bound to increase more or less yearly, so that any material curtailment of the amount paid out for postage would act as a break on the chariot wheels of progress and arrest the natural process of development. It is indeed regrettable that more cannot be afforded for postage, otherwise the list of exchanges could, with advantage, be greatly enlarged and extended, so as to embrace many public libraries and other useful institutions not at present included. The next number of the "Journal," covering the proceedings and transactions of last session, including most of the papers read at the monthly meetings and other matter relating to the work of the Society, is now passing through the press, and will be sent out in due course.

PAPERS READ.

In point of wide interest and importance, the active life of the Society has been well sustained during the past year. The ordinary monthly meetings have been largely attended by the members and their friends, who have evinced a deeply sympathetic and lively interest in all the subjects discussed. This has especially been the case on the part of the large number of ladies who have, by their presence, graced the evening gatherings. At present the number of ladies on the roll of members is comparatively small, but there has been an increase during the session, including a life member. It is, however, hoped that by the end of the ensuing financial year, there will be a much larger accession of lady supporters, as it is felt that their participation in the work of the Society is most stimulating and helpful, while their presence at the periodical assemblies exercises a beneficial influence on the proceedings, and affords encouragement to the active workers. In number and matter the papers read during the session cover a wide and representative field, there being a variety of subjects treated by the various authorities who have contributed to the literature of the Society. The session was opened in September by a popular lecture delivered to a large and representative gathering of the members and their friends by the Hon. Secretary and Treasurer, who dealt with the subject of "Celestial Geography."

In the course of his address, Dr. Thomson alluded to the prevailing lack of interest in practical astronomy, quoting Carlyle as deploring his ignorance of the subject: "Why," he used to say, "had no one in his youth taught him the constellations that were always overhead, and which he did not half know even in later life?" The fascination of the subject had been world-wide since time immemorial, but no doubt its difficulty and the prohibitive expense of even a moderate equipment, have most to do with the fact that ordinary people are content to accept this information second-hand. He then entered into a brief historic account of astronomical knowledge, tracing its development from the simple observations of the ancients, through the philosophical work of the middle ages, upon which modern knowledge was based, and illustrated his remarks by quotations from various authors. Viewed from the more modern standpoint, "Celestial Geography" was one of the most important branches of geographical science. In connection with maritime enterprises, the subject was of absorbing interest, and the positions of the sun, moon, planets, and stars were diligently and carefully observed over the great ocean highways and across the trackless deserts of the earth. A somewhat extended description of the discovery of the planet Vulcan was given, as showing how great consequences may follow from small and unpretentious beginnings, that valuable results may be obtained by the use of very primitive means, and that success in the pursuit of human knowledge depended upon individual or personal qualifications, rather than upon the elaborate or complete equipment employed. The unexplained phenomenon of the Zodiacal light was described, as were also the minor planets or asteroids. The author made reference to the transit of Venus in 1882, and that of Mercury in 1894, the former of which he had observed in Fiji, and the latter, at which the late Sir Henry Wylie Norman assisted, at the private Observatory at Toowong. This was the most successful observation made in Australasia, and the results being published by the Royal Astronomical Society, London, were given a place in the European discussion of the transit. Comets were the next to engage attention, and reference was made to the ancient popular idea that they were ominous—generally of evil—extracts from various authors being quoted in illustration. A blackboard demonstration of the methods of calculating the orbits of comets was given, and a striking illustration of the comet lately visible in the morning sky was thrown upon the screen, and its path among the constellations shown. Magnificent pictures of the moon were also exhibited, and briefly discussed, as was the fascinating subject of star depths and star clusters.

At the following meeting, another popular address was given by the Vice-President, Sir Arthur Morgan, who discoursed to a very large and appreciative audience, in a most interesting and instructive manner,

on the fascinating subject of the "Great Barrier Reef." The lecturer illustrated his remarks by what was probably the finest lantern slide pictures of the kind in existence, having been prepared by Messrs. Newton and Co., of Fleet Street, London, from photographs by the former Commissioner of Fisheries to the Government of Queensland, and kindly placed at Sir Arthur Morgan's disposal for the occasion by the Hon. Wm. Kidston, Chief Secretary.* In the course of the address it was shown that there are three primary groups of coral reefs—the atoll, the fringing reef, and the barrier reef.

The first of these groups had a wide range, extending over the equatorial zone of the South Pacific Ocean. An atoll was a typical coral island consisting of an annulating reef inclosing a lagoon. The fringing reef extended outwards from the shores of islands and the mainland of continents, and according to recent investigations, was converted into the barrier reef by the outward growth of the coral upon a talus of its own debris, forced off from the edge of the reef by the breakers. The navigable channel that usually separated the barrier reef from the mainland was formed by the dissolution and removal of dead coral rocks. All three groups were the products of the reef-building madrepore corals, consisting for the most part of the carbonate of lime, which was the same sort of substance as limestone and chalk, contained in solution in sea water. All the varieties of coral were formed by the same kind of animal, known as the "sea anemone," resembling a flower in the sea, but exhibiting all the peculiarities of a living animal when touched. These creatures were very voracious, and their activity in separating carbonate of lime from the sea and building it up into definite shapes was considerable. As these wonderful organisms were so constituted that they could only live and continue their remarkable constructive work at comparatively shallow depths, from low-tide mark to 30 fathoms, Darwin's theory of subsidence to account for the extensive development of coral reefs, formerly found very general acceptance. But this idea had now been abandoned by many authorities, in consequence of the more recent investigations of Sir John Murray, Professor A. Agassiz, and Dr. Guppy, who maintained that reefs have grown up from the tops of submerged and partly submerged banks and mountains. Dr. Guppy, who was the latest investigator in this particular field, had shown that in many cases Darwin's areas of subsidence were actually areas where the terrestrial crustal movement was upwards, and, as striking instances of the kind, allusion was made to the Eastern coast-line of Australia, North of Maryborough, and some of the coral reef zones in Polynesia, where

* The slides included: 15 views of Inshore or Fringing Reefs; about the same number of Outer Barrier reef-scapes; a couple of dozen illustrations of Sea Anemones, Trepang or Beche-de-mer, Pearls and Pearlshell and the fish which inhabit the Reef waters; some views of island scenery within the Barrier Reef; sixteen coloured chromo plates of anemones, corals, oysters, and quaintly marked fish.

his personal observations had extended over a number of years. In no part of Australasia did the geographical conditions present a more interesting field for investigation than was to be found in the region occupied by the Great Barrier Reef. Here we had an enormous belt or fringe extending for over a thousand miles northerly along the Queensland coast, upon which the active coral-producing organisms had developed a reef of enormous extent, unparalleled in any other part of the world. This fascinating area of animated nature was no doubt originally a submerged portion of the mainland, cut off during a prolonged period of subsidence, affecting most of the coast-line. The local depression was probably gradual rather than rapid, and the process of severance was no doubt influenced to some considerable extent by denudation. The sea had gradually encroached upon the land, whilst at the same time enormous masses of rocks and soils had been washed away from the adjacent ranges by the heavy rainfalls of the period. These abnormal precipitations would cut deep channels into the mountain faces and flood the low lands, removing all obstructive material except some of the older rock formations, fragments of which were now scattered over the reef area in the shape of islands or mere isolated cones. These were chiefly composed of the old sedimentary rocks, and probably represented the summit-peaks of moderately elevated ranges, now submerged. Certain it was that the geographical conditions of the region indicated the occurrence of many remarkable changes during prehistoric times, the whole area being in consequence greatly and widely influenced by upheaval and depression. The whole of Cape York Peninsula had probably been cut off entirely from the great continental mass during one of the periods of prolonged subsidence. Evidence in support of this view existed in the Herberton district. Here, in the somewhat extensive cave features of the Chillagoe area, there occurred typical example of an ancient submarine reef structure, where the old coral formation had been developed. The locality, although not an extensive one, had evidently been at some remote period invaded by the sea, and probably represented a portion of the channel or strait by which the Peninsula was insulated. The plateau now occupied by the Great Barrier Reef itself had probably been twice submerged, although at present it was apparently rising again. The crustal movement was no doubt imperceptibly slow, but the numerous raised beaches along the coast-line of the mainland and on the Eastern shores of the Gulf of Carpentaria seemed to indicate that the whole of this north-eastern portion of the continent was now affected by the influence of a gradual upward movement. How far this might extend outside the limits of the region under consideration was not yet known, but it might probably affect the whole eastern coast of Australia. During recent years much attention had been given to the occurrence, origin, and distribution of coral reefs. Within the

region of our own Great Barrier Reef, the submarine fauna had to some extent been investigated and studied by Mr. W. Saville-Kent, and more recently by Professor Agassiz and Mr. Charles Hedley, of the Sydney Museum; but the subject of reef-formation was one requiring further consideration. The observations of to-day, so to speak, had done much to clear up doubts and dispel the illusive theories of over half a century ago. Our acquired knowledge had greatly increased since Darwin's time, owing to the investigations of the "Challenger" expedition being made available, and the results obtained from other recent sources had been widely distributed. These afforded abundant evidence of the wide distribution of pelagic life, and the existence of deep-sea deposits over immense areas of the ocean bed. Sir John Murray had estimated that over sixteen tons of carbonate of lime were contained in the marine organisms which existed in every square mile of the tropical ocean for a hundred fathoms down. From this it might readily be concluded that widely distributed calcareous deposits were formed on the tops of shallow submarine banks and on the summits of submarine volcanic ridges and cones. These formations, constituting the basis of coral reefs, consisted of the foraminifera, calcareous algae, pteropoda, and many other organisms that swarmed in the surface waters of the tropical ocean. Sponges, deep-sea corals, molluscs, alcyonaria, and other associated forms were at first developed, and these prepared the beds upon which the barrier and other coral reefs were superimposed. Thus a very simple explanation of the origin of the Great Barrier Reef was submitted. The structure of this immense and unique formation was most probably of very recent age, and almost sure to be of no great thickness—certainly much less than we would suppose. Having briefly considered the origin, geographical conditions, and physical structure of the Great Barrier Reef, the lecturer proceeded to give some attention to the topography and submarine life of that fascinating region, comprising the north-eastern seaboard of our State. In doing this, a little time was occupied in submitting for inspection some pictorial representations of the remarkable forms of animated nature with which the region abounded.

The papers that were afterwards read during the remainder of the session, and printed in this issue of the "Journal," are indicated by the following titles, which give a fair idea of the nature of their contents:—(1) "The Victorian Exploring Expedition, 1861," by G. Phillips, C.E.; (2) "Holiday Rambles on the Upper Logan," by Dr. J. P. Thomson; (3) "Wanderings among the Temples and Ruins in Ceylon," by Mrs. W. Hogarth (read by Miss Alice J. Alison-Greene, of the Girls' High School, Wynnum, in the absence of the author); (4) "Dunk Island," by E. J.

Banfield (read by Mr. E. J. T. Barton, in the absence of the author); (5) "Aboriginal Navigation," by R. H. Mathews (read by the Hon. W. F. Taylor, M.D., M.L.C., in the absence of the author). These were, in all cases, illustrated by beautiful lantern slide pictures, and were evidently interesting and instructive to the members and their friends, judging by the discussions that followed their reading in every case, and the cordiality with which they were received. To the authors of these valuable contributions the best thanks of the Council are due. And in this connection the Council desires to warmly acknowledge the obligations of the Society to Mr. J. A. Beal, who, on all occasions has placed his own services and his lantern most cheerfully at the disposal of the meetings, thereby contributing in no small measure to the entertainment of the members and the success of the monthly gatherings.

As an indication of the public importance of the subjects brought before the Society from time to time through the medium of the papers read and discussed at the monthly meetings, some slight allusion may not inappropriately be made to one or two of the more recent works carried out within the metropolitan area. The most important work of all is probably the improved condition of the Brisbane River, the carrying capacity of whose channel has been greatly enlarged, so as to minimise destructive floods and increase the facilities for shipping from the bay to the very heart of the city. And it is highly gratifying to know that the idea which many years ago originated in the Society should be put into practice so soon. The subject was, first of all, discussed through the medium of a paper read before the Society on the floods that occurred in 1890, and as a means of minimising or preventing such devastations, it was suggested that in conjunction with other preventive measures, the retarding bends of the river should be cut off and the carrying capacity of the channel improved. In a very large measure this is precisely what has been done, and no doubt the navigable waterway will soon, if not so now, be large and deep enough to accommodate all the oversea shipping right up to the heart of the city. The next important matter in which the Society has for many years been interested, recently found practical expression in the illumination of the Botanic Gardens and Queen's Park, where the electric light has been installed by the Government, and the grounds opened to the public at night for recreation and amusement. The attention of the authorities had long been invited to this when the subject was discussed through the medium of a paper read before the Society as far back as 1899. From the very first, the movement was regarded as being of great public utility, and its recent consummation must be a source of gratification to all, but more especially to the members of the Society. Another matter of great national importance in which the Society has taken a deep and active interest is the

movement in favour of water conservation now being inaugurated by the State Government on perfectly sound and approved lines. It is, of course, fully recognised that some years must necessarily elapse before any tangible results can be obtained from the preliminary investigations now being conducted in different parts of the State. But it is far better to move slowly and cautiously in any undertakings of the kind, rather than to rush blindfolded into matters involving the heavy expenditure of public funds without any guarantee of success. In the sister State of New South Wales great public enterprise has recently been shown in connection with the inauguration of the Murrumbidgee water conservation and irrigation scheme, to which some attention was given by this Society in a paper read at one of the monthly meetings and published in the last issue of the "Journal." The chief seat of this gigantic undertaking is at a place now familiarly known as Barren Jack, where an immense dam is being constructed to hold back the waters of the Murrumbidgee River for irrigating the fertile lands lower down the stream. The possibilities of this huge enterprise are enormous, and it is gratifying to feel that the Society has to some extent been identified with the investigation which actually formed the superstructure of the works, and led up to the final adoption of the scheme by the Parliament and people. At the present time, however, irrigation and water conservation in Australia are in the experimental stages, and no one can, with certainty, forecast what their future will be, although the natural facilities for water storage are known to be favourable in some parts of New South Wales and Victoria. But the source of supply is not at all so certain in either of these States, and it may, after all, be found that during periods of prolonged drought, there will be a shortage. In the matter of oversea communication, the Council notes with much pleasure the success attending the efforts of the State Government to procure an extension of the fortnightly service between London and Brisbane by the Orient Pacific line of mail steamers, now calling regularly at Pinkenba for passengers and freight, and it is confidently anticipated that successful arrangements will soon be made for an additional service with the outside world via Torres Straits. These facilities of external communication, combined with a fast all-British service across the Pacific to Vancouver, through Canada, and across the Atlantic to England, would remove some of the more serious disadvantages through which Queensland has long suffered, and would place the State on a more equal footing with her Southern neighbours, whose geographical position and larger populations have so greatly contributed to successful colonisation and settlement. In this respect, it is gratifying to allude to recent developments in the direction of advertising the vast resources of the State, and the advantages offered to those who are willing to settle on the land. The Franco-British Exhibition has afforded an opportunity to a vast number of all classes of people to obtain a representative glimpse of the

industrial life of the State and of the remarkable progress made within a comparatively short period in the march of Empire. But more than this is needed to induce a larger number of desirable Britishers to settle in the country, and add greatly to the population, at present so absurdly small and inadequate. As the matter stands, very little material progress can be made without more people to fill up our cities to develop our industries, and to take up our unoccupied lands, and no great forward movement in the commercial and industrial life of the State can be expected while large areas of territory remain empty and unoccupied. It is, however, very probable that with greatly improved facilities of oversea and interstate transportation combined with an extension of our local railways, there will be attracted to our shores and across our borders large numbers of desirable settlers who will make their permanent homes in our midst and share in the development of our latent resources. To the enterprising and industrial settler Queensland offers many advantages not readily obtainable elsewhere. The climate in winter is glorious, and in the summer there are seldom any abnormal heat waves so severely experienced in other parts of the Commonwealth. In alluding to these matters, the Council is merely briefly reviewing part of the work performed by the Society for a number of years, during which time it has acted as a medium of communication with the outside world on the general scientific progress of the State and the intellectual and industrial life of the people.

Financially, the position of the Society is excellent, and has probably never been better at any time. Notwithstanding the heavy expenditure arising out of the exceptionally heavy work of the session, the financial year closes with a current credit balance of £81 3s. 8d., in addition to a fixed deposit of £249 8s. 11d., representing the Foundation Medal Fund, deposited in the bank as a capital account. The receipts from subscriptions amount to £210 9s. 6d., showing a substantial increase of £81 5s. 11d. on the income of the previous financial year. The Medal Fund, however, requires to be further increased by £50 11s. 1d. to make it self-supporting as at first intended, and in terms of the conditions set forth in the original scheme when the medal was established. The Council hopes that the deficiency will soon be made up by the members and friends of the Society, to whose liberal and voluntary contributions the Medal Fund owes its existence. As stated in previous reports of this kind, it is intended that the very handsome and valuable gold medal established in connection with the Fund should be awarded annually or at such other times as may be decided by the Council for the best papers on special subjects or for meritorious services rendered to the Society. The subjects for competition are named from time to time by the Council, and advertised in the "Journal." Members and non-members of the

Society are alike eligible to compete for the medal, but all officers and members of the Council for the time being are excluded from the competitions by the rules and regulations governing the award. So far, there have been but two awards of the medal, which is struck in London as required, and has the distinction of being the only gold medal in Australasia, in the gift of a Scientific Society.

LIBRARY.

The accessions to the Library from exchanges and other sources during the past session, have been large and important, but the available shelving space is so overcrowded as to greatly handicap the Hon. Librarian, who is obliged to pile many of the books and maps away off the shelves in inconvenient places. It is, however, hoped that adequate accommodation will soon be found for the numerous and increasing valuable publications that come to hand from time to time, and which are of great national importance as a source of reference on all matters concerning the public life of the State. Of current periodical scientific literature the shelves contain a greatly varied and constantly increasing stock, which, with the other contents of the Library, are available to members of the Society at all times and to the public, for purpose of reference under certain conditions. For the convenience of members desirous of using the library, the rooms are open from 10 a.m. till 10 p.m., and any of the books or periodicals, except permanent works of reference, may be taken out on loan by members on making the necessary entry in the Borrowers' Book, usually kept on the Council table. The Council hopes that all the members will make free use of the library, which is probably one of the largest and most representative of the kind in Australasia, containing as it does some of the world's choicest literature, including rare works of travel in many languages and the latest current accounts of scientific and general intellectual progress from the equator to the poles of the earth. In no other local institution are there similar advantages and facilities available to members.

In accordance with the usual course adopted for some time past, the Council desires to recommend:—(1) The suspension of so much of the rules as provides for the payment of an entrance fee; (2) the suspension of so much of the "rules" as will admit of the re-election of the Vice-President; (3) the reappointment of Mr. A. S. Kennedy as Hon. Librarian, and of Mr. Robert Fraser as Hon. Auditor; (4) the reappointment of Messrs. Alexander Muir and Robert Fraser as unofficial members of the Council. The Council has pleasure in also recommending that the Diploma of Fellowship under clause 3, sub-section (b) of the Constitution and Rules, be granted to Mr. J. T. Embley, licensed surveyor, who, besides being an old and greatly valued member, is one of the esteemed contributors to the literature of the Society. In this connection, mention may be made that during

the session, the Diploma of Fellowship was awarded to the Hon. John Leahy, M.L.A., who has rendered good service to the Society as a member of the Council and otherwise, and to Mr. Leonard C. Horton, of Geraldton, a life member and leading representative of the sugar industry.

While cordially thanking all those who have contributed to the success of the session by the reading of valuable and interesting papers or otherwise, the Council desires to acknowledge the obligations of the Society to Mr. A. S. Kennedy, the Hon. Librarian, and Mr. Robert Fraser, the Hon. Auditor, both old and tried officers, who have rendered valuable services. Following the course usually adopted in matters of the kind, advantage was taken of the opportunity afforded to have the Society represented in Great Britain by a member of the Council in connection with the Franco-British Exhibition, and the Hon. William Kidston, Premier and Chief Secretary, who left Brisbane for London in the latter part of the session, was duly appointed representative to all geographical societies and cognate bodies in the United Kingdom and Europe. At the same time, Mr. E. C. Barton, M.L.A., and an esteemed member of the Council, also left on a visit to England, and was appointed to act with Lord Lamington, formerly Patron, and now an Honorary Fellow, as representative of the Society at the Ninth International Geographical Congress, to be held in Geneva at the end of July, and the beginning of August current. Several other members of the Society, notably, Messrs. E. E. Edwards, George Fish, James Forsyth, H. M. Hicks, H. W. Mobsby, and J. F. Thallon, who left during the session to visit other parts of the world, including the Old Country, were provided with special letters of introduction to the parent Society in London, and to other kindred bodies elsewhere.

ABSTRACT OF THE ACCOUNTS OF THE ROYAL GEOGRAPHICAL

Dr. From 1st July, 1907,

	£ s. d.	£ s. d.
By Funds at close of last Account—		
,, Balance in Government Savings Bank	54 16 9	
,, ,, Royal ,, ...	13 0 4	
		67 17 1
,, Annual Subscriptions Received	210 9 6	
,, Interest on Government Savings Bank Deposit ..	0 19 9	
		211 9 3
		£279 6 4

Examined with Bank Pass Books, Vouchers, Etc., and found correct.

R. H. FRASER,
Hon. Auditor.

13th July, 1908.

SOCIETY OF AUSTRALASIA, QUEENSLAND.

to 30th June, 1908. Cr.

	£ s. d.	£ s. d.
To Expenditure as per Accounts—		
,, Printing "Journal"	44 12 9	
,, Postage on ,, ...	5 5 6	
		49 18 3
,, Postage on General Circular	21 0 0	
,, General Postage and Notices of Meeting	25 19 4	
		46 19 4
,, Trinity General Circular	11 11 10	
,, Hon. Treasurer	25 0 0	
,, Gas Account	1 16 3	
,, Fire Insurance Premium	2 11 3	
,, Subs. to "Nature" and P.O O.	1 11 6	
,, Office Furniture	0 17 0	
,, Hire of Chairs	3 8 0	
,, Expenses of Meetings, Cleaning Rooms, Reporting, Stationery, Etc.	53 18 3	
,, Bank Charges	0 11 0	
		101 5 1
		198 2 8
,, To Balance in Government Savings Bank	34 15 6	
,, ,, Royal ,, ...	46 8 2	
		81 3 8
		£279 6 4

J. P. THOMSON,
Hon. Secretary and Treasurer.

Donations of the members of the Royal Geographical Society of Australasia, Queensland, to Mr. Arthur G. P. Thomson's Testimonial Fund.

1908.			£ s. d.	
June 10	To Sir Arthur Morgan	chq.	2 2 0	
,, 11	T. S. Sword	chq.	1 1 0	
,, 12	Mrs. R. Edwards	chq.	1 1 0	
	E. E. Edwards	chq.	1 1 0	
	Mrs. Rodney Boyce	chq.	1 1 0	
,, 15	W. H. Rudd, Rockhampton (exch. 6d.)	chq.	1 1 0	
	George Beck, Eidsvold (exch. 6d.) ..	chq.	0 10 6	
,, 16	James Irving	chq.	1 1 0	
	By Deposit in A. J. S. Bank, Ltd., J.I. Trust a/c			8 17 6
	Exchange on Cheques			0 1 0
,, 17	To R. C. Lethbridge, Forrest Vale, Mitchell	cash	1 1 0	
	Ernest M. Waraker	chq.	1 1 0	
,, 18	I. I. McIver	chq.	1 1 0	
,, 20	Mrs. Amy Macdiarmid	chq.	0 10 6	
,, 30	By Deposit in A.J.S. Bank, Ltd., J.I. Trust a/c			3 13 0
	Exchange 6d.			0 0 6
	To George Fox .. .. .. (exch. 6d.)	chq.	1 0 6	
July 1	Harry Bracker	chq.	1 1 0	
,, 6	J. Banfield, Dunk Island (exch. 6d.) ..	chq.	0 11 6	
,, 7	By Deposit in A.J.S. Bank, Ltd., J.I. Trust a/c			2 12 0
	Exchange			0 1 0
,, 9	To A. H. Blackman	chq.	1 1 0	
	Alex Corrie	chq.	1 1 0	
	J. C. Rumpf	cash	1 0 0	
,, 10	Charles B. Lethem, C.E	chq.	1 1 0	
	W. A. Wilson	chq.	1 1 0	
	By Deposit in A.J.S. Bank, Ltd., J.I. Trust a/c			5 4 0
	To Edgar W. Walker, 23/6/08		0 10 6	
	By Deposit in A.J.S. Bank, Ltd., J.I. Trust a/c			0 10 6
	To Wm. Stafford, Booval (exchange 6d.)	chq.	0 10 6	
,, 15	R. M. Collins	chq.	2 2 0	
	By Deposit in A.J.S. Bank, Ltd., J.I. Trust a/c			2 12 0
	Exchange			0 0 6
	To James Stodart	chq.	1 1 0	
	L. F. Schoenheimer	chq.	1 1 0	
,, 16	Thos. Calvert, Gladstone (exch. 6d.)	chq.	1 1 6	
	By Deposit in A.J.S. Bank, Ltd., J.I. Trust a/c			3 3 0
	Exchange			0 0 6

				£	s.	d.	£	s.	d.
18	To W. J. Scott	chq.		1	1	0			
,, 20	W. B. Slade (exchange 6d.)	chq.		1	1	0			
	J. Colenso Cartledge, c/o F. J. Heussler, Miles, Q.	chq.		0	10	0			
,, 21	Miss Alice J. Alison Greene	chq.		1	1	0			
	P. E. O. Reid, Charters Towers (exch 6d.)			1	1	0			
	By Deposit in A.J.S. Bank, Ltd., J.I. Trust a/c						4	13	0
	Exchange						0	1	0
				31	9	6	31	9	6
	By exchange on cheques 4/6, bank charges or fee 5/-.								
	Leaving credit balance in A.J.S. Bank, Ltd.			31	0	0			
,, 22	To E. J. T. Barton	chq.		0	10	6			
	Fred J. Heussler	chq.		0	10	6			
,, 23	George Phillips	chq.		1	1	0			
,, 24	W. J. Coakes	chq.		2	2	0			
,, 25	Hon. F. T. Brentnall	cash		0	10	0			
,, 28	A. S. Kennedy	chq.		1	1	0			
,, 29	Mrs. Janet Walker	chq.		1	0	0			
,, 30	L. C. Horton	chq.		1	0	0			
	James Irving	cash		1	9	0			
	By sealskin leather purse						0	4	0
	Balance						40	0	0
				40	4	0	40	4	0

uly 30th, at the Annual General Meeting of the Royal Geographical Society of Australasia, Queensland, a purse containing forty sovereigns was presented to Mr. Arthur G. P. Thomson.

JAMES IRVING, M.R.C.V.S.L., F.R.G.S.A.Q., V.D.,
Lieut.-Colonel, C.M.F., Q.

Royal Geographical Society of Australasia,

QUEENSLAND.

FOUNDED 1885.

DIPLOMAS OF FELLOWSHIP.

The following gentlemen have been awarded the Diploma of Fellowship under Section IV. of Clause 3, Constitution and Rules (*See page 2 of Cover*):—

Honorary:

His Excellency Sir William MacGregor, G.C.M.G., C.B., M.D., LL.D. D.Sc., Hon. F.R.S.G.S., etc.

The Right Hon. Lord Lamington, G.C.M.G., G.C.I.E., B.A., F.R.G.S., Hon. F.R.S.G.S., etc.

Under subsections (a and b) :—

Lieut.-Col. James Irving, P.V.O., Q.D.F., M.R.C.V.S L.

Charles Battersby, Esq., J.P.

Robert Fraser, Esq., J.P.

E. M. Waraker, Esq., J.P.

R. M. Collins, Esq., J.P.

Alexander Muir, Esq., J.P.

C. B. Lethem, Esq., C.E.

John Cameron, Esq., M.L.A.

Hon. Arthur Morgan, M.L.C.

Hon. C. F. Marks, M.D., M.L.C.

Hon. F. T. Brentnall, M.L.C.

James Stodart, Esq., M.L.A.

J. R. Atkinson, Esq., L.S., J.P.

L. F. Schoenheimer, Esq., J.P.

Ald. John Crase, J.P.

Hon John Leahy, M.L.A.

L. C. Horton, Esq., J.P.

J. T. Embley, Esq., L.S.

Rev. L. L. Wirt, B.D.

LIST OF MEMBERS.

(P) Members who have contributed papers which are published in the Society's "Proceedings and Transactions." The numerals indicate the number of such contributions.

(PP) Past President.

A dagger (†) prefixed to a name indicates a member of the Council.

Life members are distinguished thus (*).

Should any error or omission be found in this list, it is requested that notice thereof be given to the Hon. Secretary.

Foundation Members:

P1 Atkinson, J. R., J.P., FELLOW, Lic. Surveyor, Ipswich, Queensland.

Marks, Hon. C. F., M.D., M.L.C., FELLOW, Wickham Terrace Brisbane.

P1*Moor, T. B., F.R.G.S., F.R.S.Tas., Strahan, West Coast, Tasmania.

P1†Muir, A., J.P., FELLOW, 354 Queen Street, Brisbane.

P36PP*Thomson, J. P., LL.D., Hon.F.R.S.G.S., etc., Hon. Secretary and Treasurer, Wood Street, South Brisbane.

Members:

Affleck, Thos. H., "Westhall," Freestone, Warwick, Q.

Aldridge, H. E., J.P., "Baddow," Maryborough, Queensland.

Alford, Henry King, J.P., "St. Audries," Toowoomba, Queensland.

Allan, David Muir, Engineering Supply Co. Ltd., Edward Street, Brisbane.

Alison-Greene, Miss Alice J., Moreton Bay Girls' High School, Wynnum.

Archer, Edward Walker, J.P., M.H.R., Targinnie Station, Yarwun, Queensland, and Parliament House, Melbourne, Victoria.

P1 Banfield, Edmund James, J.P., Brammo Bay, Dunk Island, via Townsville, Queensland.

*Barrett, Mrs. Walter, Eagle Junction, Brisbane.

†Barton, E. J. T., Bowen Terrace, New Farm, Brisbane.

†Barton, E. C., M.L.A., Electric Supply Co., Ann Street, Brisbane.

Battersby, C., J.P., FELLOW, Georgetown, Queensland.

Baynes, Harry S., Water Street, South Brisbane.

Beal, J. A., Lands Department, Executive Building, Brisbane.

Beck, John George Henry, J.P., Morton Street, Eidsvold, Q.

Bembrick, Rev. M. L., Lufilufi, Samoa.

B.I. and Q.A. Coy. (The Manager), Mary Street, Brisbane.

Blackman, A. H., Chief Engineer's Dept., Railway Offices, Brisbane

Blair, Hon. J. W., M.L.A., Parliament House, Brisbane.

Borton, Mark W., Lands Office, Toowoomba, Queensland.

Bowden, Mrs. H., "The Mansions," George Street, Brisbane.

Boyce, Mrs. Rodney, "Kenilworth" William Street, off Ipswich Road, South Brisbane.

Bracker, Henry, J.P., "Glencoe," Clayfield, Brisbane.

P1†Brentnall, Hon. F. T., M.L.C., Fellow, "Eastleigh," Coorparoo, Brisbane.

Broadbent, Kendall, Museum, Brisbane.

Brooke, John, J.P., Croydon, Q.

Brown, J. Leonard, J.P., "Woggonora," Cunnamulla, Q.

Bruce, Capt. William, "Haroldton," Mowbray Terrace, East Brisbane.

Bull, Arthur. Box 121, Durban, S. Africa.

Buzacott, G. H., "Fernyside," Kelvin Grove, Brisbane.

Calvert, Thomas, J.P., Glassford Creek, Q.

P1 Cameron, John, Fellow, Courier Building, Brisbane.

Cameron, Charles Christopher, "Coolabah," Ipswich.

*Cameron, Pearson Welsby, J.P., Nicholas Street, Ipswich, Q.

*Campbell, A., J.P., Glengyle Station, Birdsville, Queensland.

Campbell, Norman, Board of Waterworks, Brisbane.

Cartledge, John Colenso, c/o F. J. Heussler, Survey Camp, *via* Miles, Q.

P1 Chelmsford, His Excellency the Rt. Hon. Lord, K.C.M.G., Patron, Government House, Brisbane.

Carter, Hon. A. J., M.L.C., Royal Norwegian Consulate, 35 Eagle Street, Brisbane.

Carvosso, Wm. Couche, J.P., Charlotte Plains, via Hughenden, Q.

Cherry, Frederick James, J.P., Mining Warden and P.M., Cooktown, Q.

Clewett, Hon. Felix, M.L.C., "Selma," River View Terrace, Hamilton, Brisbane.

Coakes, W. J., Messrs. Finney, Isles and Co., Brisbane.

P2PP*Collins, R. M., J.P., Fellow, Tamrookum, Beaudesert, Queensland.

Collins, William, Nindooinba, Beaudesert, Q.

Corrie, Leslie G., J.P., F.L.S., 375 Queen Street, Brisbane.

*Corrie, Alex., J.P., 375 Queen Street, Brisbane.

Costin, C. W., Parliament House, Brisbane.

Crase, Ald. John, J.P., Fellow, Warren Street, Fortitude Valley, Brisbane.

*Crorkan, T., J.P., ——————

Crowe, P. W., 331 Queen Street, Brisbane.

Cummins, J. J., Lic. Surveyor, Survey Office, Brisbane.

Davies, Ald. John, J.P., West End Pharmacy, S. Brisbane.

De Conlay, James, J.P., Warwick, Q.

Dick, James, J.P., Cooktown, Q.

Douglas, Henry Alexander Cecil, M.L.A., Parliament House, Brisbane.

P2Eaton, Capt. Wm., Princhester Street, South Brisbane.

Edwards, Edward E., B.A., "Bryntirion," Wickham Terrace, Brisbane.

Embley, J. T., Fellow, L.S., Blackall, Q.

Fairfax, J. Hubert, J.P., "Marinya," Cambooya, Q.

Fish, George, J.P., South Brisbane.

*Foot, J. A., J.P., Warrinilla, Rolleston, Queensland.

Forrest, Hon. E. B., M.L.A., Messrs. Parbury and Co., Eagle Street, Brisbane.

Forsyth, James, "Braelands," South Toowong, Brisbane.

†Fox, G., M.L.A., Yeronga, near Brisbane.

†Fraser, Robert, Fellow, J.P., Charlotte Street, Brisbane.

Gregory, F. W., Bellevue Hill, Victoria Road, Rose Bay, Sydney, N.S.W.

Greenham, Dr. Eleanor Constance, Edward Street, Brisbane.

Griffin, William Charles, J.P., Nelson, via Cairns, Q.

Pl PP Griffith, Rt. Hon. Sir S. W., G.C.M.G., M.A., etc., "The Albany," Macquarie Street, Sydney, N.S.W.

Groom, Hon. H. L., M.L.C., Toowoomba, Q.

Hannaford, S., J.P., Marble Hills, Glenlyon, Stanthorpe, Queensland.

Harbord, H. H., J.P., Maytown, Queensland.

Hertzberg, A. M., J.P., Hertzberg & Co., Charlotte Street, Brisbane.

Heussler, Fred, J., Survey Camp, *viâ* Miles, Q.

Hicks, H. M., J.P., Mary Street, Brisbane.

Hillcoat, Reginald E. R., J.P., Boomarra Station, via Donaldson, Queensland.

Pl Hirschfeld, Eugen, M.D., etc., Wickham Terrace, Brisbane.

*Hodel, F. C., J.P., Thursday Island, Torres Strait, Queensland.

Pl Hogarth, Mrs. William, Stonehenge, Millmerran, Q.

*Holt, W. H., F.R.C.I., "Glanwyne," Manly Point, Manly, N.S.W.

*Horton, Leonard Cecil, J.P., fellow, "The Gunyah," Johnstone River, Q.

†Irving, Lieut.-Col. J., M.R.C.V.S.L., J.P., Fellow, Ann Street Brisbane.

Johnson, William Guard, J.P., Palmerin Street, Warwick, Q.

Johnston, Robert Henderson, F.V.C.M., F.I.G.C.M., Limestone Hill, Ipswich, Q.

Kennedy, A. S., Hon. Librarian, Kingsholme, Fortitude Valley, Brisbane.

Kelly-Cusack, William George, P.M., etc., Ravenswood, Queensland.

†Kidston, The Honourable William, M.L.A., Executive Building, Brisbane.

Leahy, Hon., John, M.L.A., Courier Building, Brisbane.

Lethbridge, Robert Copland, J.P., Forest Vale, Mitchell, Q.

Lethem, C. B., C.E., Feelow, Clayfield, Brisbane.

*Lewis, A. A., J.P., Oxley, near Brisbane.

Loria, Dr. August, Dock Street, South Brisbane.

MacDiarmid, Mrs. A. A., Crow's Nest, Q.

MacGinley, J. J., Survey Office, Brisbane.

MacMahon, Philip, Director of Forests, Executive Building, Brisbane.
Macansh, Thos. W., "Mie Gunyah," Warwick, Queensland.
Mackie, R. Cliffe, River View Terrace, Hamilton.
May, T. H., M.D., Bundaberg, Queensland.
*McConnel, J. H., J.P., Cressbrook, Queensland.
McClymont, Miss, Kedron Street, Wooloowin, Brisbane.
McDonald-Terry, A. J., J.P., Kirknie Station, Clare, via Townsville.
McGroarty, D. C., Jane Street, West End, South Brisbane.
McIver, I. I., J.P., Bulgroo, Adavale, Queensland.
McLeod, Alex., J.P., Elizabeth Street, Brisbane.
McMahon. J. T., Racecourse Road, Hamilton, Brisbane.
Menzies, Mrs. W., "Menzies," George Street, Brisbane.
Miles, Hon. E. D., M.L.C., New Farm, Brisbane.
Mobsby, H. W,, Agricultural Department, William Street, Brisbane.
P1†Morgan, The Hon. Sir Arthur, Kt., M.L.C., FELLOW, Vice-President Parliament House, Brisbane.
Moreton, The Hon. B. B., M.L.C., "Waratah," Maryborough, Q.
Moss, R. D., Messrs. Dalgety & Co., Elizabeth Street. Brisbane.
Munro, J. H., J.P., "Ness Bank," Toowoomba.
Murphy, The Hon. Peter, M.L.C., Hamilton, Brisbane.
Murray, Hon. J. H. P., Chief Judicial Officer, Port Moresby, Papua.

Nathan, Maurice A., J.P., Messrs. S. Hoffnung & Co., Ltd., Charlotte Street Brisbane.
Needham, F. H., Canning Downs, Warwick, Queensland.
Nelson, W. M., Tramway Office, Countess Street, Brisbane.
Nicholas, C. E., J.P., Stannery Hills Mining and Tram Coy., via Cairns, Queensland.

Outridge, P. P., Redland Bay, Queensland.
O'Connor, Thos., L.S., "Duporth," Oxley, Brisbane.
O'Hara, R. E., Glenelg, Warwick, Q.
O'Reilly, Charles, Dornoch Terrace, South Brisbane.

Paine, A. A., J.P., Brandon, via Townsville, Queensland.
*Parker, Francis, J.P., St. Albans, via Monkira, Queensland.
Parker, William Richard L.D.S., Eng., Rothwell Chambers, Edward Street, Brisbane
Parr, Mrs. B. C., "Mai Gunyah," Warwick, Queensland.
Parr-Smith, Mrs. A., "Underly," Edmonstone Street, South Brisbane.
Pears, Philip W., M.A., Police Magistrate, Warwick. Q.
Perrett, Arthur, J.P., Kaboonga, Kinbombi, Q.
P4†Phillips, George, C.E., Telegraph Chambers, Queen Street, Brisbane.
*Plant, Major C. F., F.R.A.S., "Ferndale," Ashgrove, near Brisbane.

Quaid, J. D., J.P., Mountcastle's, Albert Street, Brisbane, Queensland
Quinlan, C. E., District Engineer, Toowoomba, Q.

Radcliffe, O., Inspector of Schools, Graceville, near Brisbane.

Raff, Alex. C., C.E., Railway Offices, Roma Street, Brisbane.

Raff, Hon. Alexander, M.L.C., Gregory Terrace, Brisbane.

Reid, P. E. A., J.P., Queensland National Bank, Limited, Charters Towers, Q.

Rigby, W. A., J.P., South British Ins. Coy., Queen Street, Brisbane.

Rudd, William Henry, J.P., Rockhampton, Q.

Rumpf, J. C., J.P., "Karlsruhe," Boundary Street, South Brisbane.

Sandrock, George Frederick, J.P., "Fredsara," The Range, Rockhampton, Q.

Shepherd, Arthur, J.P., Milray Station, Pentland, N.Q.

†Schoenheimer, L. F., J.P., FELLOW, 43 Regent Street, Paddington, Sydney, N.S.W.

Scott, W. J., Under Secretary for Public Lands, "Kaieta," Toowong, Brisbane.

Simmons, Rev. Hugh, M.R.S.A., F.V.C.L., "Mascotte," George Street, Brisbane.

Slade, W. B., River Terrace, Milton, Brisbane.

P Sorell, John Arnold, 99 Club Arcade (P.O. Box 833), Durban, South Africa.

Spence, Lockhart Horsburgh, J.P., Brisbane.

Spencer, Adkins Robert, Dentist, 12 Queen Street, Brisbane.

†Spowers, Allan A., Surveyor-General, Survey Office, Executive Building, Brisbane.

Squire, Eustace, Landsborough Downs Station, Hughenden, Q.

Stafford, William, J.P., "Rothwell," Booval. near Ipswich, Q.

*Stevens, Hon. E. J., M.L.C., Southport, Queensland.

Stodart, James, M.L.A., FELLOW, Market Street, Brisbane.

Stuart, John, J P, "Burley," Royalist Road, Mosman, Sydney, N.S.W.

Sword, T. S., J.P., Land Court, Brisbane.

Sykes, Henry R., Royal Insurance Co., 355 Queen Street, Brisbane.

*Taylor, W. B., "Blackdown House," Toowoomba, Queensland.

Taylor, Hon. W. F., M.D., M.L.C., etc., 8 Wharf Street, Brisbane.

Thallon, J. F., J.P., Eagle Junction, Brisbane.

The Bodleian Library (The Librarian), Oxford, England.

*Thomas, J. S., "Eblana," Penkivil Street, Bondi, Sydney, N.S.W.

Thomas, Hon. Lewis, M.L.C., "Brynhyfryd," Ipswich, Queensland.

P5 Thomson, Capt. W. C., "Loma Langi," Ascot, Brisbane.

P1 Tolmie, J., Toowoomba.

Waddell, W. A., Koorboora, via Cairns, Queensland.

Walker, Edgar W., J.P., New Zealand Ins. Co., Queen Street, Brisbane.

Walsh, A. D., Dalgety and Co., Elizabeth Street, Brisbane.

Waraker, E. M., J.P., FELLOW, Chief Surveyor, Survey Office, Brisbane.

Watts, J., Dalby, Q.

*Weedon, W., Selby House, Wickham Terrace, Brisbane.

*Weedon, S. H., C.E., L.S., Box 44, G.P.O., Sydney, N.S.W.

Wilson, W. A., J.P., care of Messrs. B. G. Wilson and Co., Queen Street, Brisbane.

Wilson, A. W., J.P., General Agent. Charters Towers, Q.

Wirt, Rev. L. L., B.D., FELLOW, Memorial Hall, Faringdon Street, London, E.C., England.

Woolrabe, Dr. F., M.R.C.P., F.R.C.S.Edin., D.P.H., Health Dept. Brisbane.

Yates, W. D., J,P., Treasury Chambers, George Street, Brisbane.

Honorary Members:

Lady Norman, Royal Hospital, Chelsea, London, S.W., England.

The Right Hon. Lord Stanmore, G.C.M.G., etc., House of Lords, London, England.

H.H. Prince Roland Bonaparte, 10 Avenue d'Iena, Paris, France.

Sir Clements R. Markham, K.C.B., F.R.S., etc., 21 Ecclestone Square, London, S.W., England.

P1 His Excellency the Right Hon. Lord Lamington, G.C.M.G., G,C.I.E., B.A., F.R.G.S., Hon. F.R.S.G.S., etc., Lamington, Lanarkshire, Scotland.

P1 Sir John Murray, K.C.B., LL.D., D.Sc.. F.R.S., House of Falkland, Falkland, Fife, N.B.

Lady Nelson, "Gabbinbar," Toowoomba, Q.

Honorary Corresponding Members

His Excellency Sir William MacGregor, G.C.M.G., C.B., M.D., LL.D., D.Sc., Hon. F.R.S.G.S., etc., Govt. House, St. Johns, Newfoundland.

John Tebbut, Esq., F.R.A.S., etc., etc., Private Observatory, "Peninsula." Windsor, N.S.W.

P3 H. R. Mill, Esq., LL.D., D.Sc., F.R.S.E., F.R.G.S., F.R.S.G.S., Director, British Rainfall Organisation, 62 Camden Square, London, N.W., England.

P1 S. P. Smith, F.R.G.S., New Plymouth, New Zealand.

Sir Sandford Fleming, K.C.M.G., LL.D., C.E., Ottawa, Canada.

Hon. W. T. Harris, Ph.D., LL.D., Commissioner of Education· Washington, D.C., U.S.A.

P17 R. H. Mathews, L.S., Associé étranger Soc. d'Anthrop de Paris ; Corr. Memb. Anthrop. Soc., Washington ; Corr. Memb. Anthrop. Soc., Vienna ; "Carcuron," Hassall Street, Parramatta, N.S. Wales.

Mrs. J. P. Thomson, Wood Street, South Brisbane.

His Excellency Sir G. R. Le Hunte, K.C.M.G., Govt. House, Adelaide,

Rt. Rev. Dr. Gerard Trower, D.D., Bishop of Likoma, British Central Africa.

Pl His Excellency the Hon. W. L. Allardyce, C.M.G., Government House Stanley, Falkland Islands.

Pl Professor Richard Elwood Dodge, Teachers College, Columbia University, New York City, U.S.A.

Cathcart William Methven, M. Inst.C.E., Club Arcade, Durban, South Africa.

CONSTITUTION AND RULES

OF THE

ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA,

QUEENSLAND.

FOUNDED 1885.

Amended at a Special General Meeting, March 21, 1900.

The Royal Geographical Society of Australasia, Queensland, was formed at a meeting held at the Town Hall, Brisbane, on the 10th July, 1885.

Title.

1. "The Royal Geographical Society of Australasia, Queensland."

INTERPRETATION—SOCIETY.

Whenever the word "Society" is used in the following Rules and Bye-laws, the same shall be read and construed to mean the Royal Geographical Society of Australasia, Queensland.

Objects.

2. The objects of the Society are:—

A—GENERAL.

I. Scientific—The advancement of geographical science in its widest sense: the study of physical geography, and the exploration of Australasia, with the islands and seas adjacent thereto, and to obtain information upon their physical features, fauna, flora, geological formations, etc.

II. Commercial—The study of commercial geography, natural and artificial products, and the manufactures of various countries.

III. Educational—The dissemination of knowledge of physical, commercial, and political geography amongst all classes, by means of public lectures and publications.

IV. Historical—The collection and publication of historical records of geographical interest, and of memoirs of men distinguished by the advancement of geographical science in Australasia.

B—SPECIAL.

I. The collection of material for the compilation of a reliable Geography of Australasia.

Constitution.

3. The Society shall consist of Ordinary, Corresponding, and Honorary Members and Fellows.

I. Any lady or gentleman may become an Ordinary Member, subject to election.

II. Persons of distinguished scientific attainments, who have promoted the objects of the Society, may be elected Corresponding Members.

III. Honorary Members shall be elected from among such eminent persons as have rendered valuable service in the cause of geographical science.

IV. Fellows—The Council may confer the Diploma of Fellowship upon such eminent persons as have rendered valuable services to geographical science; on persons of distinguished scientific attainments; on those who have promoted the objects of the Society; and on Honorary and Honorary Corresponding Members of the Society, without the payment of diploma fees. On Ordinary Members, on payment of a nominal diploma fee, subject to the following conditions, namely:—(*a*) Upon written application: Those who have compounded for life membership and are deemed worthy of the distinction by the Council. (*b*) Upon written application: Those who are not in arrears with their annual subscriptions, and are, upon the recommendation of the Council, approved by the Society at an ordinary monthly meeting. Of the honorary class the number of Fellows shall not exceed ten. Each Diploma, after being approved by the Council, shall be signed by the President, and by the Hon. Secretary of the Society. Members who receive the diplomas shall have the privilege of designating themselves "Fellows" of the Society, and may use the initials F.R.G.S.A.Q. after their names as long as they continue to be members of the Society.

Election and Privileges of Ordinary Members.

4. Every person desirous of admission as a member of this Society shall be nominated by two Ordinary Members; the nomination (to be in Form I of the Appendix) to be delivered to the Secretary in writing, and submitted to the Council at its next meeting, and at the next ordinary monthly meeting thereafter the name of such person shall be put up for election.

5. Every person so elected shall, upon payment of his entrance fee and subscription, become a member of this Society; and shall be presented by the Secretary with a copy of the rules, and a Diploma of Membership.

6. The Ordinary Members of the Society have the right to be present and vote at all meetings of the Society; to introduce two visitors at the general or ordinary meetings upon entering their names in the visitors' book; but no visitor shall take part in a discussion unless specially invited to do so by the Chairman. Each member to be entitled to receive a copy of the Society's official publications, and to have access to the library and other public rooms of the Society.

7. Any Ordinary Member is eligible to be an officer or member of the Council of this Society.

Election of Corresponding and Honorary Members.

8. The Corresponding and Honorary Members shall be elected under the same conditions as laid down in Rule 4 for Ordinary Members. They shall be exempted from the payment of fees, and may exercise the privileges of Ordinary Members, except that they shall not vote or hold office or seat on the Council.

Government by Council.

9. The government of the Society shall be vested in a Council consisting of twelve (12) members including the officers, all of whom shall be elected annually by the Society as hereinafter directed.

Officers.

10. The officers of the Society shall consist of a President, a Vice-President, an Honorary Secretary, and an Honorary Treasurer.

Property.

11. The Council shall have the management of the affairs and property of the Society, and the disbursement of the funds.

12. The whole of the property and effects of the Society of what kind soever shall be vested in the President, the Vice-President, the Honorary Secretary, and the Honorary Treasurer for the time being, in trust for the use of the Society.

Election of President and Vice-President.

13. The President and Vice-President shall be elected by ballot, at an Annual General Meeting of the Society, and shall be eligible for re-election, provided that they shall not hold office for more than two (2) years successively. The President, or in his absence the Vice-President, shall preside at all meetings of the Society and of the Council, at which he may be present.

Election of Honorary Secretary and Honorary Treasurer.

14. The Honorary Secretary and the Honorary Treasurer shall be elected by ballot at an Annual General Meeting of the Society, and shall be eligible for re-election.

Election of Ordinary Members to the Council.

15. The election of Ordinary Members to the Council shall be by ballot at an Annual General Meeting of the Society.

Duties of the Council.

16. The Council shall meet once in every month for the transaction of business, at such time and place as may be appointed. Special meetings of the Council may be convened at any other time on the authority of the President, the Vice-President, or of three members of the Council. Due notice of all Council meetings to be sent to each member.

17. The Council shall prepare an annual balance-sheet, and a report on the operations of the Society for the preceding year, for presentation at the Annual General Meeting.

18. No business shall be transacted at any meeting of the Council unless three members of the Council are present; in case of equality of votes, the Chairman shall have an additional or casting vote.

19. It shall be the duty of the Council to decide on the papers to be read at the monthly meetings, and to determine as to their publication, in whole, or in part.

20. Any member of Council personally interested in a question before the Council, shall, if requested to do so by the Chairman, withdraw during its consideration.

21. If, in the interval between two annual meetings, any vacancy in the Council occurs, the Council may appoint some member of the Society to temporarily fill such vacancy until it is filled by election at the Annual General Meeting.

Duties of the Honorary Treasurer.

22. The Honorary Treasurer shall have special charge of all moneys and accounts, and shall see to the collecting of all moneys due to the Society, and shall submit quarterly to the Council a list of the names of such members as may be in arrears with their subscriptions. He shall pay all moneys received into a bank account, to the credit of "The Royal Geographical Society of Australasia,' Queensland."

23. All accounts due by the Society shall be approved by the Council before being paid, and all payments shall be by cheque, signed by the Honorary Treasurer, and countersigned by one of the Council members.

24. The Honorary Treasurer shall prepare an annual statement of receipts and disbursements, to be audited by Auditors appointed at the preceding annual general meeting. Any vacancy occurring in such appointment to be filled by the Council.

25. This statement shall be submitted, audited, to the Council at its meeting prior to the annual general meeting.

Duties of the Honorary Secretary.

26. The Honorary Secretary shall attend and take minutes of the proceedings of the Society and of the Council respectively, and see that all such minutes are entered in the several minute books, and shall keep a complete list of the members of the Society, with the name and address of each accurately set forth; he shall conduct all correspondence, and transact all the routine business; and shall have charge of all property, books, maps, papers, etc., and shall see that the same are properly recorded and catalogued.

Fees.

27. Ordinary Members shall pay £1 1s. entrance fee, and subscribe £1 1s. per annum, payable in advance, to the Honorary Treasurer, on or before the first day of the session.

28. A member may at any time compound for future annual contributions by the payment of the sum of £10 10s.

29. Members elected during the second half of the session shall pay half the usual fee for that year. No member shall be responsible for any expenditure beyond his annual subscription.

30. Any Ordinary Member who has not paid the year's contribution, during the currency of the year, shall be liable to have his name removed by the Council from the list of members of the Society: Provided always that written application for the same shall first have been made by or on behalf of the Treasurer: And provided, also, that the Council shall have power to restore the defaulter's name at his request, and after payment of arrears. No member shall be entitled to vote or hold office while his subscription for the previous year remains unpaid.

Session.

31. Session shall commence in the month of July, and last eight calendar months.

Meetings.

32. The meetings of the Society shall be:—

I. Annual general meeting.
II. Ordinary monthly meeting.
III. Special general meeting.

33. The annual general meeting shall be held at the commencement of every annual session in the month of July, on a day to be fixed by the Council, to receive the President's address and the report of the Council on the state of the Society, and to discuss such subjects as may be brought forward relative to the affairs of the Society, and

to make the elections for the ensuing year. If, after the lapse of fifteen minutes, less than ten members are present, it shall not be lawful for the meeting to proceed to business, except for the purpose of adjournment. and the meeting shall stand adjourned until a day and time then resolved upon.

34. The ordinary monthly meetings of the Society shall be held in each month of the session, on such days and at such place as the Council may appoint. The business shall be conducted in the following order, unless otherwise decided:—

I. The reading and confirming the minutes of last meeting.

II. Election of new members.

III. The Secretary shall announce any donations made to the Society since its last meeting, and read any special communications.

IV. Motions, of which notice has been given, to be considered, and notices of motion for the next meeting to be read.

V. The consideration of any special subject which members may desire to bring forward, provided it be approved by the Chairman.

VI. Any paper or subject notified in the circular shall then be read.

VII. The Chairman to invite discussion.

VIII. Notice of papers for next meeting.

35. No motions relating to the government of the Society, its Rules or Bye-laws, the management of its concerns, or the election, appointment, or removal of its officers, shall be made at any ordinary monthly meeting.

36. Except as above provided, no paper shall be read at any meeting which has not been notified to and approved by the Council; and every paper read before the Society shall be the property thereof, and immediately after it has been read shall be delivered to the Secretary.

37. A special general meeting shall be called by the Council when considered necessary, or when required by the requisition in writing of any ten members to do so, the requisition to specify (in the form of a resolution) the purpose for which the meeting is required to be called; and at the meeting the discussion shall be confined to the subjects mentioned in the notice convening such meeting. Ten members shall form a quorum.

38. All meetings of the Society shall be convened by notice written or printed, sent by the Secretary to every member resident in the colony, at least seven days before the date fixed for meeting. The circular shall state as far as convenient the subjects to be brought before the meeting.

39. The President shall take the chair at all meetings of the Society; or, in the event of his absence, the Vice-President; or, in the event of his absence, members present shall elect a Chairman, being a member of Council, if such be present.

40. No person shall at any meeting, unless with the express permission of the Chairman, address the meeting otherwise than in a standing position.

Retirement of Members.

41. Any member may, on payment of all arrears of his annual contribution, withdraw from the Society, by signifying his wish to do so by letter under the member's own hand, addressed to the Secretary. Such member shall, however, be liable for the contribution of the year in which the wish to withdraw has been signified, and shall also continue liable for the annual contribution until all books or other property borrowed shall have been returned to the Society, or full compensation for the same, if lost or not forthcoming, shall have been made. Should there appear cause in the opinion of the Council to require the retirement from the Society of any member (otherwise than as provided by Clause 30), a special general meeting shall be called by the Council for that purpose; and if three-fourths of those voting agree by ballot that such member shall retire, the Chairman shall declare the same accordingly, whereupon the name of such person shall be erased from the list of members.

Archives.

42. The archives of this Society shall be kept in Brisbane.

Publications.

43. A journal of the Proceedings and Transactions of this Society shall be published from time to time under the authority of the Council.

Alteration of Rules.

44. Any repeal or alterations of the Rules, or additions thereto, of the Society, shall not be considered unless a written notice of motion, signed by not less than five members, shall have been given to the Council and read at three ordinary monthly meetings of the Society, and thereupon such motion may be brought forward at the next annual general meeting; or, if thought desirable, a special meeting may be convened before such annual general meeting to consider the resolution; and any resolution passed at such special meeting, altering or repealing the rules, shall be in force until the annual general meeting next following, and, if not then confirmed, shall thereafter be held void and of no effect.

Bye-Laws.

45. The Council shall have power to make Bye-laws for the conduct of its business and the business of the Society generally: Provided no such Bye-laws shall be repugnant to the objects of the Society, or to any Rules or Bye-laws made by the Society at any of its general meetings.

BYE-LAWS RELATING TO COMMUNICATIONS TO THE SOCIETY.

1. Every paper which it is proposed to communicate to the Society shall be forwarded to the Honorary Secretary for the approval of the Council.

2. The Council may permit a paper written by a non-member to be read, if communicated through a member.

3. In the absence of the authors, papers may be read by any member of the Society appointed by the Chairman or nominated by the author.

4. No paper or communication read before the Society shall be published without the consent of the Council.

5. The Council shall decide, not later than at its meeting next following the reading of a paper, whether or not it shall be printed in the proceedings; and if not, such paper shall be returned, if desired, to the author.

6. All communications intended for publication by the Society shall be clearly and legibly written on one side of the paper only, with proper references and in all respects in fit condition for being at once placed in the printer's hands.

7. In order to assure a correct report, the Council requests that the paper shall be accompanied by a short abstract for newspaper publication.

8. The author of any paper which the Council has decided to publish, will be presented with twenty copies; and he shall be permitted to have extra copies printed, on making application to the Honorary Secretary, and on paying the cost of such copies.

9. A proof corrected by the MS. shall be submitted to the author for revision.

OUTRIDGE PRINTING CO., QUEEN ST., BRISBANE, QUEENSLAND.

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24th SESSION,

1908-1909.

P. THOMSON LL.D., Hon.F.R.S.G.S., Etc., Etc., *Honorary Editor.*

The Authors of Papers are alone responsible for the opinions expressed therein

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THE

Royal Geographical Society of Australasia,

QUEENSLAND.

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SUGGESTION.

Every person desirous of bequeathing to the Society any money is requested to make use of the following

FORM OF BEQUEST.

I give and bequeath to the Honorary Treasurer for the time being, of the Royal Geographical Society of Australasia, Queensland, *the sum of* ....

....

for the benefit of the said Royal Geographical Society of Australasia, Queensland, to be expended as the Council of the said Society may deem expedient for the promotion of Geographical Science or the purpose of exploration in Australasia.

N.B.—All Donations presented to the Royal Geographical Society of Australasia, Queensland, are acknowledged by letter and in the Journal of Proceedings.

NOTE.—All Communications should be addressed to the Hon. Secretary at the Rooms of the Society, Public Library Building, William Street Brisbane, Queensland.

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WITH THE NAVIGATORS ON THE COMMONWEALTH COAST: The IMPERATIVE NEED for ADDITIONAL LIGHTHOUSES, with SPECIAL REFERENCE to the COAST OF QUEENSLAND.*

By L. C. HORTON, F.R.G.S.A., Q.

In essaying a contribution on the above very important subject, the writer has undertaken a task which he would fain have left to a more able pen; however, as the matter is one upon which he has felt very strongly for many years, and having at last grown tired of waiting; also, in view of the grave seriousness of the case he has endeavoured to set forth concisely and clearly, where and why extra lighthouses are needed. In eliminating the picturesque, which is inevitably inseparable from sections of a vessel's course that will presently be traced from north to south, the writer does so with regret, but intends, nevertheless, to severely repress the tendency to its inclusion, in order that there may be nothing to cloud the great importance of the real issue.

The very fact that the lighthouses—which the writer is now going to recommend—have not long since been erected, is ample proof that the urgent need of them has not yet been grasped; but he ventures to hope that when greater ventilation has been given to the existing need, the long required will be achieved.

The matter is undoubtedly one of public weal or woe, and is of direct or indirect personal interest to most, apart altogether from the moral interest which everyone should take in seeing that others are not needlessly exposed to unnecessary dangers on land or sea.

In reviewing this article, it will be found that most of the extra lighthouses are required on the Queensland coast, and for that reason the writer has set forth the course usually followed by the interstate tramps plying on the Commonwealth coast from the south to Cooktown—Cooktown being about the farthest north these vessels steam.

* Read before the Royal Geographical Society of Australasia, Queensland, December 11, 1908.

Commencing, therefore, a voyage south from this historical spot a vessel keeps the leading lights of the Endeavour River. bearing forty-four degrees east, in line. A course is then steered out gradually, say south, twenty-five degrees east, for Mount Saunders ; the light that will then be visible being that of Grassy Hill (which is one of the third or fourth order), on a twenty-foot tower, erected five hundred and seventy feet above sea level, and visible for about fourteen miles. After losing Grassy Hill light, the next one to be picked up will be Archer Point on account of its greater altitude, which light is sected thus :—First a white light which dims and then shows green, next white again and finally red--these sectors are to guide the navigator in steering clear of existing reefs. Thus, by keeping the course illuminated by the white light he is enabled to steer clear of D reef and Blackbird Patch. Continuing to keep the white sector ahead and steering south-east half south he should bring Archer Point abeam, passing about a mile off same. Steering south by east half east for approximately six and a half miles, should bring Mount Thomas abeam (the summit of which mountain is generally visible at a very considerable distance).

The navigator should now be able to see Rocky Island light, and by keeping this light, and that of Archer Point in line, and steering south-east by south a quarter south, he should safely pass E Reef, though only about half a mile away ; and also, the Hope Islands, about two and a quarter miles distant.

This course is kept with these lights in line, till within about thirteen and a half miles of Cape Tribulation (thus well named by Capt. Cook, as being the promontory of Black Rock reef, on which his vessel the " Endeavour " struck).

These lights will now be lost, a course being set south-east by south three-quarter south for thirteen and a half miles, which should bring Cape Tribulation abeam and about one and a half miles to starboard, though, on a dark night, it is generally impossible to sight this Cape. Allowance here must be made for tides, which, being influenced by the wind, are naturally variable.

On the extreme point of Cape Tribulation a light of good magnitude is badly needed and should long ago, have been erected. Particularly would it be of great assistance to navigators from south to north, as they would then be able to pick up this much required light after losing that of Low Island, which possesses a minute revolving white light placed at an elevation of 65 feet and visible for about 14 miles.

With Cape Tribulation abeam, a course is set south three-quarter east for thirteen and a half miles, picking up Low Island light, which

should bring Schnapper Island abeam, about one mile distant on the starboard. A course is now set for Island Point south by west for some two and a half miles, and passing Low Isles at a distance of about two miles.

Continuing on the same course for another eight miles, the vessel should reach Island Point (now called Port Douglas, which shows a red light and has an anchorage of about four and a half fathoms of water.

Leaving the anchorage at Island Point, with the red light thereon closing in, a course is set east by south a quarter south, which in six and a half miles should bring the Wentworth Buoy abeam about a mile distant. This buoy is placed very close, probably not more than half a mile from the Wentworth Reef. The Alexandra Reef lies at the back of the former, and the said buoy is only about four and a half miles from the mainland. With the Wentworth Buoy abeam, the course set is south-east a quarter south for twenty-five and a half miles, when the lights of Cairns Harbour should be visible to the navigator.

The vessel, after leaving Cairns Harbour, and having cleared the light beacon at the entrance to the cutting, will have a course set to steer past Cape Grafton about one mile distant, but before reaching this Cape the light beacon will have been shut out. After passing Cape Grafton the navigator will have to shape his course down between very dangerous reefs and islands without any light whatsoever.

The course recommended in the sailing directions coming southward from Cape Grafton is between High Island and Normanby Island (two of the Frankland group), the alternative course being to the eastward of these Isles, but as the soundings in the vicinity are unreliable and very sparse, the latter course is not a desirable one. Should this alternative course be followed, there is great risk of being set over towards dangerous ground and discoloured water, charted as only four miles distant from the course so taken.

Continuing on its course, the vessel will have to steer 30 and a half miles before coming within range of the North Barnard light (visible approximately for fourteen miles), and in thick weather, of course, this light is only visible at a much shorter distance.

The North Barnard light should be a flashing or revolving light, instead of a fixed one, and if the writer is not in error, it was originally a flash light until something getting out of order, it was apparently left stationary, which does not answer the same purpose.

As already pointed out, the track recommended lies between High Island and Normanby Island, giving a margin of only two and two-third miles. This particular danger could be avoided were a

light placed either on Fitzroy or Russel Island—Fitzroy Island for preference—as this would also assist the navigator when navigating from south to north.

Proceeding on our journey to the south, even supposing North Barnard Island has been passed safely, a course has to be shaped about south-south-east for twenty-nine miles so as to pass between Brook Island and Kennedy Shoal, with only a margin of eight miles, and, as the currents here sometimes run at the rate of two knots an hour, and are ever varying, it is a most dangerous spot to approach if the weather is at all thick. This applies to vessels bound both north and south. Kennedy Shoal consists of boulders and coral, and a vessel is just as likely to be set on to Kennedy Shoal as on to Brook Island. It is imperative that a light be placed on South Brook Island to make navigation reasonably safe. A distance of ninety four and a half miles has to be traversed from the North Barnard Island light to the lighthouse on " Bay Rock " (situate to the westward of Magnetic Island). The navigation on this track is very intricate, and it is to be greatly lamented that a lighthouse has not long since been placed on one of the Palm Islands, preferably Electra Head, as this would be visible to vessels going either north or south. Were this light placed on North Palm Island it would be shut out from a vessel going from south to north by Great Palm Island. Continuing south after passing Palm Isles the navigation is comparatively free from danger as " Cape Cleveland Light " would be picked up by ordinary care even in thick weather, the light being a very good one and visible in normal weather for about twenty miles.

A vessel having passed Cape Cleveland, on which is erected a very good light, a course is set to pass Cape Bowling Green light (a distance of twenty-five miles). This light was originally a very good one visible about 16 miles and therefore of great service to navigators, but as it was built on a foundation which proved treacherous on account of shifting sands, great anxiety for some years was felt for its safety, and it has now been replaced by a temporary fixed light, visible for a distance of only nine miles.

It is to be hoped this will be replaced by a light of at least equal magnitude to its predecessor ; though probably a light visible for sixteen or eighteen miles is all that is required, as it is doubtful whether—on account of the low lying character of the land—a light would be visible at any greater distance. This light should be passed at a distance of at least five miles, on account of the dangerous reefs and sand banks in the vicinity.

A course has then to be shaped for Gloucester Island, seventy miles distant. This island has no light whatever on it, notwithstanding that

Gloucester Head, the northern extremity of Whitsunday Passage, would be an ideal site for a lighthouse. The difficulty of making the entrance to this passage in thick weather is so great, that if a navigator is unable to pick up Gloucester Head, he has simply no option but to heave to until the weather clears.

Should the weather become thick after passing Gloucester Head and entering the straits from the northward, there is absolutely no light visible until passing Molle Island, twenty nine and a half miles distant, the navigator in the meantime having to steer clear of the Archipelago through which Whitsunday passage threads its way.

The outer track passing to the eastward of Rattray Island could have been taken if it were intended to take this course when passing Gloucester Head, that is, if the prevailing conditions should have made it advisable. But even then it would be extremely dangerous on account of having to pass several islands, with the chance of miscalculating one's distance, as the the tides rushing through the passage are of very different strengths at different times of the year. Even by taking this outside route Molle Island would have to be passed before picking up " Dent Island Light " at the southern entrance of the passage, which light is visible (where not shut in by Molle Island) for a distance of sixteen miles, Molle Island shutting out that light from a vessel coming southward. It would thus have to be approached to within a distance of eight miles before becoming visible.

A sad historical note in connection with the lighthouse on Dent Island is that of January, 1896, when the Customs cutter, " Dudley," taking the usual periodical supplies, was overtaken by the cyclone " Sigma " and was lost with all on board.

A light placed on Hannah Point, the northern extremity of North Molle Island, would be a splendid guide for the navigator after having lost the light proposed to be placed on Gloucester Head. A navigator entering the straits from the southward, is guided by Dent Island light, and could shape a course to steer through the passage, until he opens up the light proposed to be placed on Hannah Point.

The navigation through this passage is most unsafe in thick weather, there being absolutely no light in the centre nor at the northern end of same, and it is imperative in order to make navigation safe, that these lights be placed where recommended. Still coming south, and having passed Dent Island, the vessel with no light astern to guide her in thick weather, must pass at a distance of one mile and a half, a very dangerous shoal, namely, Long Shoal, with a maximum depth of ten feet at low water. The ever varying currents in the vicinity, setting across the passage and making this portion of the course extremely dangerous.

Were a light placed on Hammer Island, seventeen and a half miles south-east by south half south from Dent Island, a navigator would possibly be able to pick up same, and thus minimise the risk of going on Long Shoal, or the islands to the eastward (several of these islands consisting of small rocks).

A light on Hammer Island would also be of great assistance to vessels approaching from the southward, as it would be a guide to clear the islands. after having passed the Blackwood Shoals, which lie to the northward of Port Mackay, and extend for a distance of thirteen and a quarter miles to the north of that Port.

It must be remembered that the comparatively heavy draught ships such as "Wyreema," "Wyandra," "Cooma," "Bombala," and "Yongala," etc., now used on these coasts, make navigation more difficult than in years gone by, and yet facilities—which in those days were deemed insufficient for boats of much lighter draught—are now apparently considered adequate for present day navigation.

To continue, having passed Hammer Island, and steering to the south-eastward, without calling in at Port Mackay (in itself a dangerous feat of navigation in thick weather), the navigator has absolutely no guiding light for ninety-one miles, the nearest light being situated on Pine Islet, on the north-west extremity of the Percy Islands, and visible for twenty miles.

The light on Flat Top Island, being a second class light, visible only nineteen miles in clear weather, is absolutely useless to a navigator proceeding to the south-east, as he would pass Flat Top at least fifteen miles off, when it would be quite impossible for him to pick up this light in thick weather.

To enable a navigator to avoid the Blackwood Shoals, and to assist him, when bound in or out of Port Mackay, a light should be placed on Keswick Island at the north-west end, Keswick Island bearing north by east threequarter east from Flat Top Island, and distant 17 miles could be passed to within 2½ miles with every safety. The proposed light on this Island would enable the navigator to see his course past Double Island, 37½ miles away, where a light should also be placed, having passed which a course could be set to pass Pine Islet light distant 28 miles.

It must be borne in mind that the navigation from Hammer Island to Pine Islet is made particularly dangerous by the cross currents which set practically north-east and south-west, at a very varying rate of time and velocity, few navigators finding that much reliance can be placed upon calculations from tide tables.

The foregoing courses apply to a vessel taking the route outside

Prudhoe Island, but a vessel having called at Mackay, will go through the Prudhoe Channel—that is between Prudhoe and Reid Islands, steering about east south-east from Port Mackay. The Prudhoe Channel between the shoal off Prudhoe Island and Reid Island, is only one mile and a half wide, it being too dangerous to steer a course to the southward of Reid Island, on account of the Viscount Shoals. Of course this only applies to the larger vessels before alluded to.

A light in the centre of Reid Island would be invaluable, as it would be a guide for steering through the Northumberland Islands and Beverley Group.

After steering through the Beverley Group, going south,—Pine Islet light is then visible, and can be passed about five miles to the south-westward ; after which a course must be shaped to pass about four miles to the southward of Onslow Point, on South Percy Island, about five miles off ; the navigator having to avoid a dangerous rock just showing above high water on the starboard side, the currents in the vicinity setting across the vessels track at a rate of from two to two and three-quarter knots an hour. This danger could be avoided by keeping a bearing off Pine Islet light, but on proceeding further to the south-eastward, there is a very dangerous rock ten feet high only, namely, "Low Rock," to the north-north east of Steep Island (five miles distant), which only gives a margin of three and three-quarter miles on that course.

A light on Steep Island (which is four hundred and nine feet high), would be a great boon to navigators, (Steep Island being amply large for the provision of a light-house and station), and this is one of the most urgently required lights on the coast ; inasmuch as it is seventy-seven miles to Barren Island at the entrance to Keppel Bay, from which Cape Capricorn light is visible in fine weather ; though if the weather should be thick, a course will have to be shaped to pick up the Capricorn light, which is twenty-one miles distant from Barren Island.

This applies of course to a vessel not calling at Keppel Bay, but if bound into Keppel Bay, Sea-hill light is the next light to be picked up after passing Barren Island, distant nineteen and a half miles, though visible only seventeen miles ; and, as the weather in Keppel Bay is liable, at all seasons of the year, to become thick and hazy, there is no option but to stop a vessel when she has run her distance, by calculation, until the weather clears, although these lights, viz :—Cape Capricorn and Seahill—are undoubtedly placed on the best points available. A light on Hummocky Island would be of little more value to navigators than the one already existing on Cape Capricorn.

The usual course shaped by vessels after passing abreast of Port Mackay, is, outside the Percy Islands, shaping a course to pass North Reef light, visible only thirteen miles, on account of the light house being situated practically on the waters level, and being distant 134 miles from the middle of the Percy Group.

In thick weather this is a most dangerous route, as the track itself is through discoloured water, and also through numerous reported shoals very casually surveyed, the soundings often being insufficient, and the currents very variable.

Should this outer route past North Reef light be taken, another long distance occurs, viz :—72 miles to Lady Elliot Island, on which is erected a good light visible for twelve miles, but unavoidably placed at a low altitude on account of the lowness of the land here. This light, certainly placed in the best position available, is of great assistance in rounding Sandy Cape Spit, projecting 19 miles beyond Sandy Cape light, which though a magnificent one of the first order, and visible for 27 miles, is unfortunately often obscured in thick weather, on account of its great attitude, viz. 400 feet above sea level.

This light is at present a revolving one, but should be altered into a quick flashlight, so that it might be visible more frequently, as, in thick weather it may be seen onee, and not perhaps again for a very long time. It could well be modelled on that of Ushant, which was altered after the loss of Drummond Castle on the adjacent rocks.

This light is of very great importance to vessels as a turning point, when bound to Keppel Bay, Gladstone, etc.

Too severe exception cannot be taken to the fact that such a remark as "requires further examination"—is allowed to appear on the navigating charts in the close vicinity of the end of this spit, more particularly in view of the fact that the "Aramac" went ashore there only some few years ago; which disaster was probably caused by an abnormal current, the captain of the vessel being admittedly one of the most careful navigators on the coast. What is there to prevent a heavy hollow pile being screwed down or established in some other way at the end of the spit, and charged with gas, similar to gas buoys which burn for several weeks ; and even supposing it were possible to place only a small light, it would certainly be an invaluable guide for navigators, as the pile could be seen in the day time, and would give greater confidence in rounding the Spit.

On the inner track a course may be shaped from Cape Capricorn light to within five or six miles of Bustard Head light, distance forty-two miles from Cape Capricorn.

This course, which is usually taken by vessels from Keppel Bay, is well lighted, as Bustard Head light is a magnificent one visible twenty-four miles ; but the outer route is generally taken by vessels bound direct from Port Mackay to Brisbane or other southern ports.

After having rounded Sandy Cape and passed the dangerous spit, a course can be shaped with Sandy Cape light, abeam about eleven miles south half east for Caloundra Head, passing Double Island Point (distant seventy-three and a half miles), about six miles away. Double Island Point lighthouse is a magnificent light of the first order, being visible twenty-four miles, and is erected at an altitude of three hundred and fifteen feet on the best point available for that route, which is practically free from all dangers, though a vessel bound to the northward, after having passed Double Island Point light, would find more difficulty in picking up Sandy Cape in thick weather, as Sandy Cape light is shut in by Indian Head, seventeen miles distant. A light is therefore urgently needed on Indian Head, as a navigator could then proceed with confidence when going north.

Others beside the writer are aware that many of these lights now recommended have, on previous occasions, been petitioned for by master mariners, who have been promised that the subject would receive consideration, though apparently without result.

Continuing south, having passed Double Island Point, the navigator approaches Moreton Bay, which is at the present time as well lighted as any navigator could desire.

After leaving Cape Moreton, a vessel still bound south, shapes a course about south-south-east, to pass Point Lookout, four or five miles distant, on which point a light is most urgently needed for vessels proceeding either north or south. Navigators of vessels coming from the south would find this light of the utmost value, as they would know when to keep off for Cape Moreton twenty-six and a half miles distant, Cape Moreton light often being obscured by mists or rain squalls.

Having passed Point Lookout, forty-five miles must be steered to pass Point Danger, off which some dangerous shoals extend from three and a half to four miles to seaward.

The light at present on Point Danger, visible only from 12 to 13 miles in clear weather, is a fixed light of very small power, which could easily be mistaken for a steamer's mast-head light.

A first-class flashlight is urgently needed here to enable the navigator, in thick weather, to take his bearings to clear the Point Danger Shoals.

As Cape Byron light (twenty-seven miles to the southward of Point Danger), is also a flashlight, the flashes of the one proposed on Point Danger should be of a distinctly different character.

Having passed Cape Byron light, which is a first-class one on the very best position available, the Richmond River light will shortly be picked up, distant fourteen miles. This light, it is understood, could easily be made more powerful at little expense, and is a matter which well merits attention.

The next light to the Richmond River, is at Clarence River Heads, visible for twelve miles, and which can only be seen with any certainty in the clearest of weather. This light should also be made a revolving light of the second magnitude.

After passing the Clarence River Head light, the next to be seen will be the South Solitary Island light (forty-seven and a half miles distant); a first-class revolving light, visible nineteen miles, and erected at an altitude of one hundred and ninety-two feet above sea level.

The navigation of the coast after passing the South Solitary Island is comparatively easy, and the only lights wanting an increase of power between that and Sydney Heads are :—Crowdy Head and Tacking Point, which are now both fixed lights of the third class, visible only about twelve to fourteen miles.

These should both be increased in power, and altered to revolving and flashlight respectively, to the second magnitude at any rate.

From here to Sydney Heads, the navigation is comparatively safe and the course well lighted. It seems passing strange that practically none of these first-class lights have been placed upon the most difficult and dangerous points of navigation, viz :—on the Queensland coast, an oversight which it is sincerely trusted will very soon be rectified.

Having passed Sydney Heads and continuing south, the coast is well lighted past Gabo Island (two hundred and thirty-seven miles south of Sydney Heads), when a course is shaped for Wilson's Promontory (distant one hundred and ninety miles.)

But before picking up this light, Cliffy Island light (visible about twenty miles, and a first-class flashlight), will be seen.

After passing Cliffy Island, the light upon Wilson's Promontory, which is a fixed white one, will be picked up ; this is only a second-class light, and could with the greatest advantage be altered to a revolving light of the first magnitude.

After passing Wilson's Promontory, the navigation is easy, when proceeding either to Melbourne or to Cape Otway.

On the other hand when a vessel is proceeding from Melbourne to the Promontory, the light at Wilson's Promontory is completely shut in by the islands adjacent to the westward, and a light placed on the North Glennie Isles is most urgently needed. This should be a flashlight of the first magnitude, to distinguish it from the revolving light at the Promontory. This particular light has on several occasions been petitioned for without avail, but it is to be hoped that it will be installed before some great marine disaster has established a monument to procrastination.

After leaving Port Phillip, the coast is well and sufficiently lighted until the navigator reaches Albany.

Leaving Albany, a course is taken between Eclipse Island and the Passage Rocks, a distance of only three and three-quarter miles.

A revolving light of the first magnitude is urgently needed on Eclipse Island (three hundred and fifty-seven feet in height). This light could be made visible at least twenty-four miles distant, and would be a great boon to navigators, not only when leaving Albany to the westward, but also to vessels travelling eastward to enter King George's Sound.

Otherwise, on this route from Albany to Fremantle, the only exception to the lighting that need be taken is, "that the flash of the light at Cape Leuwin could, with advantage, be made of longer duration, the present flash being so rapid that it is almost impossible to take a correct bearing to the same.

Voyaging from Melbourne to Tasmania, the proposed light on the North Glennie Islands would be of the utmost value to navigators enabling them to get exact distance off same, and to shape their course accordingly, otherwise the lighting is satisfactory.

In shaping a course from Sydney to Tasmania, the navigator takes the distance off Gabo Island light, and then shapes a course, which possesses no unforseen dangers through want of sufficient lighting.

To summarize, the writer has recommended the establishment of sixteen new lighthouses, and alterations in nine existing lights on the Commonwealth coast.

Out of the sixteen new lighthouses required, fourteen are necessary on the Queensland coast, one on the coast of Victoria, and one on the West Australian coast.

Of the nine alterations recommended, three are to lights on the Queensland coast, four to those on that of New South Wales—one to a light on the Victorian coast—and one to a light on the coast of West Australia, which will explain the writer's preliminary sentence, "with special reference to the coast of Queensland."

Though the establishment of these new lighthouses, and the required alterations to existing ones, may cost a very considerable sum, and the annual maintenance of the same, a further considerable sum, these facts cannot for a moment, be held to be justifiable grounds for the non-carrying out of such urgently required additions and alterations as have been disclosed.

Unfortunately, there have already been too many disastrous wrecks on the Commonwealth coast, and therefore no effort should be spared to prevent any future addition to such an appalling list on which will be found engraved: the loss of the "Quetta," off Adolphus Island on the coast of Cape York Peninsula; the loss of the "Gothenburg," on Perar Reef, off Holbourne Island, near Bowen; also the loss of the "Loch Vennacher," on the Young Rocks, on the Southern coast of Victoria. Again that of the "Eliza Ramsden," off the entrance to Port Phillip; the "Loch Ard," near Moonlight Head, on the south coast of Victoria; and others, in addition to existing evidences of equally disastrous wrecks at a much earlier period than any of the foregoing.

Finally, the writer, who has had very frequent opportunities of judging, regrets to have to state that, considering the intricacies of navigation, the coast of Queensland, must at present, be considered, "one of the worst lighted in the world;" and if this article should conduce to the greater ventilation of the existing needs, and thus be the means of helping to bring about a so urgently required better state of affairs, the writer will consider himself amply rewarded.

SUMMARY OF THE PROCEEDINGS OF THE 9th INTERNATIONAL GEOGRAPHICAL CONGRESS, HELD AT GENEVA IN 1908.*

(With One Plate.)

By E. C. BARTON, M.L.A., Delegate.

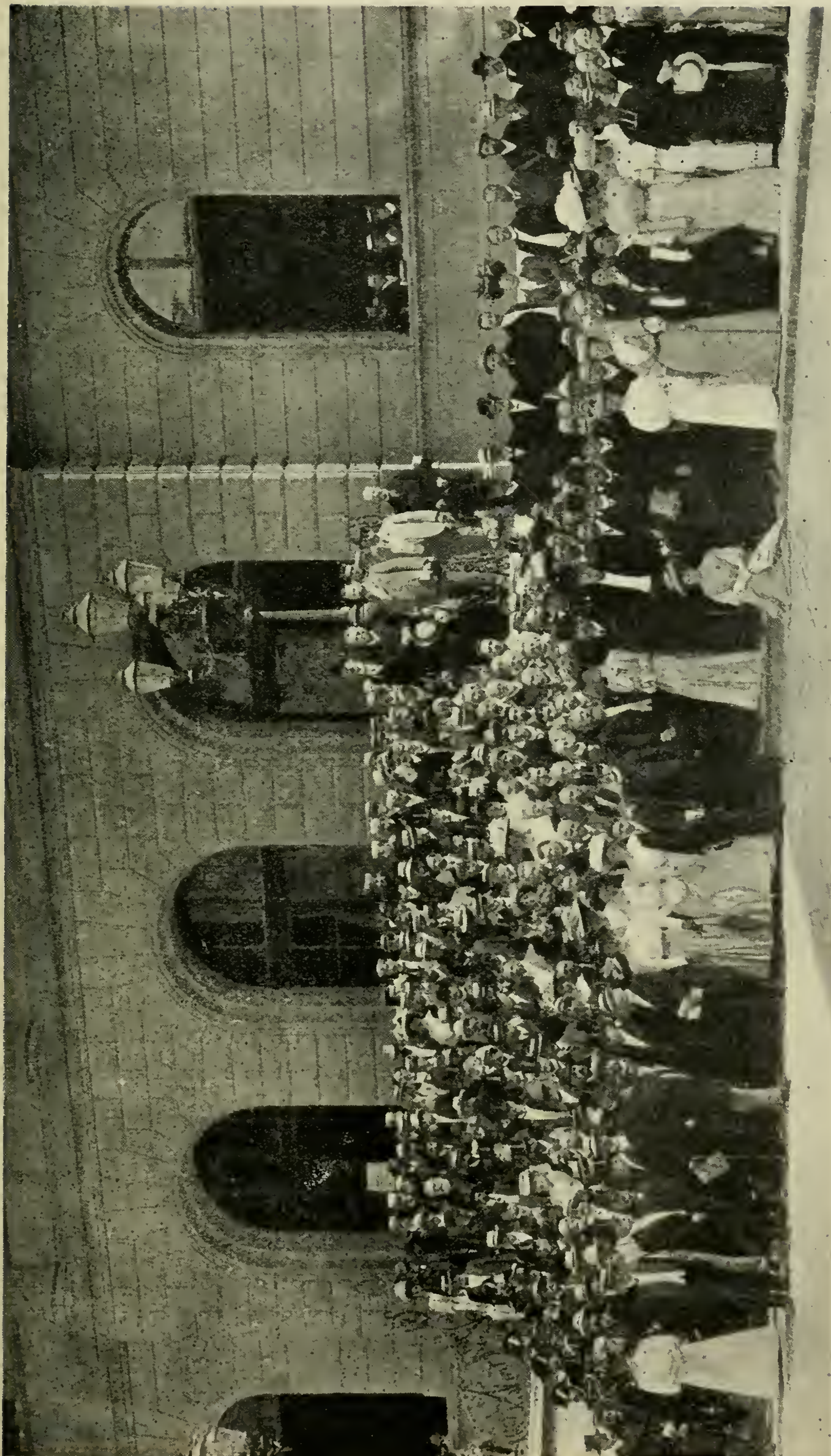
I come before you as a returned ambassador might come, having delivered the message with which I was entrusted by you in April last year, to the International Geographical Congress, which was held in the city of Geneva, in the month of July of last year. The message was to the effect that the Congress was invited to hold its next meeting in Brisbane; but although I had the sanction of our Queensland Government in making such an invitation, I regret to have to inform you that it was not seriously entertained. But then I had the consolation of seeing the invitations of some twenty other towns meet the same fate; and the only propositions that were really considered were those of Buda-Pest and Rome. Rome carried the day, owing to feeling that it would have been an injury to the sensibilities of Vienna to have selected the twin-city of the plains. In spite of my want of success in this matter, I should like to put on record my appreciation of the hospitality and courtesy shown to your delegate, and to express the hope that I may be privileged to represent this Society at the forthcoming Congress at Rome, and thus be able to take advantage of the honour which the last Congress conferred upon me, and may he preside over the deliberations of the section devoted to "Rules and Nomenclature" of which I was elected a Vice-President in conjunction with Commander Roncagli, Professor Matzuoka, and Mr. Chisholm.

The Congress itself was very interesting, both as to the subject matter of the papers and the discussions, and as to the method adopted by the Committee entrusted with the organisation of meetings and social functions. The centre of the proceedings was the University of Geneva, which, with the spacious buildings of the Athenæum, was placed at the disposal of the Congress. A number of volunteers from among the local students of the University were daily in attendance at the various lecture rooms, and displayed the utmost courtesy to all the visitors, showing them about the buildings, and affording them every information. On arrival at the University Hall, each member of the Congress was presented with a large envelope from the Secretariat. At the same time he was asked to write down

* Read before the Royal Geographical Society of Australasia, Queensland, April 28, 1909.

his name and local address, and was then introduced by the Secretary to the President, or any members of the Committee who happened to be present. In his envelope he found what might be called a series of "surprise packets." Firstly, there was to be found a map of the town and neighbourhood, and a small book descriptive of all the possible excursions; the sailing time of the Lake steamers; postal regulations; railway information; lists of hotels, with tariffs; and other useful notes. There were several of these booklets, some published by the Cantonal Government, some by Local Societies, and others by the Tramway Department. The next "lucky packet" was a set of gilt-edged cards of invitation to the several functions to which the members of the Congress were invited, and which proved to be entertainments of great magnificence. On one occasion, for instance, the members were taken in two large steamers all round the beautiful Lake of Geneva. At every large town on the border of the Lake, we were entertained by the Local Authorities, and altogether the delegates spent a very happy and interesting day. On two other occasions we were the guests of private persons.

A decorative badge, which was also found in the envelope, proved very useful, as well as ornamental; for it was a perfect open sesame to every door in Geneva. Even in the street or on the tram cars, the badge was effectual in attracting the kindly interest of the citizen of Geneva, giving him an excuse for conversing and showing to the stranger the beauties of his native place. The social side of the Congress was undoubtedly the most successful to the eye of the participant; and I must confess to a feeling of disappointment when it came to the real work of the sections as they met each day in the various lecture halls of the University. The sections were excessively subdivided, and the papers were so numerous, that it was quite impossible for the visitor to attend more than one out of any six papers of interest to him. My experience of the meeting of the British Association in Dublin, during the ensuing month showed however, that the reading and discussion of papers at such meetings is of small importance. The real object of a Congress is to give an opportunity to the men of science of bringing before the World an account of the most recent steps in their special studies. By this means is secured that frequent interchange of thought which lies at the root of the rapid progress made by science during the last twenty years, compared with the previous century. The reader of a paper not only gains publicity, but also has the benefit of so putting his communication on record that no rival can afterwards claim the credit of his discovery—glory and renown being apparently the goal of the enthusiasts who frequent such congresses.



9TH INTERNATIONAL GEOGRAPHICAL CONGRESS, GENEVA, 1908: DELEGATES.

To such as myself, it was however very disconcerting to find that on a certain Tuesday, 25th July, there would be sitting in the forenoon in seven different rooms, seven sections of the Congress, and that simultaneously there would be read "The Influence of Leonardo da Vinci and the Renaissance on the Study of Geography," by the Austrian Professor, Hummer; "The Botanical Geography of Paraguay," by Professor Chodat, of Geneva; "The Prevalence of the Valley Formations in the Morphology of Mountain Ranges," by Professor Lemburg; "School Maps as used in Switzerland," by Dr. Linder, of Basle; "Affiliation of the Geographical Societies of the World," by Professor Libbey, of Princetown; "Physical Geography of the Sea," by Rear-Admiral Chester; and "Pleistocene Upheavels as the Probable Cause of the Growth of Glaciers."

Then there was the uncertainty as to whether a paper would be read at all. Frequently, in the absence of an author, it happened that a paper was taken as read, no arrangements having been made for reading by the Secretary, as is often done in the case of papers read before an English Society.

The most important work of the Congress from a utilitarian point of view was undoubtedly that of the Cartographical Committee who met for the purpose of establishing international uniformity in the construction of a set of maps on a scale of 1 ; 1,000,000 which is being carried out by the majority of countries represented at the Congress. Intimately connected with this attempt at uniformity in cartography is the work of the Committee of "rules and nomenclature" mentioned above, to whom has been entrusted the work of bringing about uniformity in the matter of names throughout the geographical world. That this will prove no easy task is evident to anyone considering the names by which places and towns are known in different countries, as in the case of the German town of "Aachen," which is known in English and in French communities by the name of "Aix-la-Chapelle," and that of the Straits of Dover which are known to the French as the "Straits of Calais." A curious instance of this difficulty was given at the Congress in a discussion which took place on the subject of a paper read by M. Roux, a member of the Swiss Federal Parliament, and representative of the City of Geneva. The paper was on the subject of "The name of the Lake of Geneva," in which the representatives of the geographical world were practically asked to arbitrate in the local quarrel between the inhabitants of Geneva and the inhabitants of all the other towns on the same Lake, as to whether the Lake should be known to the world as Lake Leman, or by the more recent name of Lake Geneva.

The section which drew the greatest amount of attention, was Section IV., referring to glaciers. The battle raged for many days between the rival schools of glaciarists. Those led by Professor Brunhes of Freiburg, claimed that most of the erosion usually attributed to the scraping action of the ice was actually due to the action of the water which invariably flows under the ice in one or more streams. This view is vigorously opposed by Dr. Plenck, of Berlin, and his adherents. Of course, the subject of glaciers was one particularly suited to the districts, and the excursions that followed the Congress were all more or less connected with the subject. A striking feature of the Congress was the use of four languages—French, German, Italian, and English, which were officially recognised. The first three, being spoken in the cantons of the Swiss Confederation, were necessarily recognised by the Committee, and English was adde because it was well known that the English speaker seldom learns foreign languages.

It would be impossible to more than enumerate the leading features of the multitude of papers read at the Congress, and therefore, I shall not attempt to give even a resume of the subjects brought forward at the Congress, more especially as an exact account of the proceedings will be published in 1910. I may say at once, that to me, coming from the other end of the earth the most attractive part of the proceedings lay in the opportunity of coming into contact with men whose names had been known to me for many years. To see these men and have speech with them was indeed a great joy. To meet at the breakfast-table men such as Bartholomew, the map maker of Edinburgh, and Chokalsky, the Russian hydrographer; to have a chance of meeting Arminius Vambery, Scott-Keltie, and many others was quite an experience for me.

While in Geneva there were opportunities given between the sittings, to investigate the neighbourhood, and the members found much to interest them. Geneva is a charming city, and offers subjects of the greatest interest to almost everyone who visits it. To the ardent geologist, naturalist, archæoligist or meteorologist, the attractions are endless, while to the socialist it is the Mecca sacred to the memory of Jean Jacques Rousseau. Even from a commonplace modern point of view Geneva is a place to admire, especially in regard to Municipal matters. Like all the Swiss cities, it forms a state or canton, and as such it forms part of the Confederation. It is as independent as the State of Queensland—raises money by income tax and such like means, and carries on its own educational department, all in its own little territory, which is smaller than Bribie Island. It was

a separate sovereign state until the year of Napoleon's exile to Elba, when it joined the Swiss Confederation. The citizens are a well-to-do people, they are lightly taxed, as taxation goes in Europe, and the city has large revenues from bequests. In this matter it has been particularly fortunate, one of the latest benefactors being a personage from whom the sturdy little republic could scarcely have expected such a windfall. The donor was the Duke of Brunswick, one of the dispossessed princes of Germany, who retired to England on the loss of his royal position and lived very comfortably on a couple of millions which constituted his private property, and which he was commonly reputed to have devised to a member of the English Royal family. In the sixties, some mistake occurred at Buckingham Palace, whereby His Highness was subjected to an indignity in the matter of precedence—some Prince with thirteen quarterings being allowed to precede him, who was possessed of fourteen quarterings. The Duke thereupon left England and took up his abode in Paris, and was supposed to have altered his will in favour of the ill-fated Prince, Louis Napoleon, who lost his life subsequently in South Africa. In Paris, however, he again met with trouble; for the police would not let him gallop his horse through certain streets at night and so he shook the dust of their city off his feet and passed on to Geneva. He lived there for some years, when a severe frost occurred, and this was the cause of his death, for his horse slipped and fell in the main street and in their plunging they dashed into a large plate glass window. He reached home in a state of high nervous excitement; and when a notice came in from the City Council calling upon him to pay for the broken window and damaged goods, his rage knew no bounds. He sent for his solicitor, to get his will altered, but he died of apoplexy before the man of law arrived. When his will was opened, it proved to be a deed of gift of some millions to the City of Geneva. The City Fathers were so pleased that they have erected a monument to his memory, in a prominent position on the river bank.

Although my subsequent travels did not form a part of my embassy, I hope that they may be of sufficient interest to members to justify my giving some account of them here. From the Geneva Congress I went to the Dublin meeting of the British Association, and there I had an opportunity of hearing several papers on a favourite subject—meteorology—and of meeting M. Teisserenc de Bort, Dr. Shaw, Mr. Rotch, Mr. Lempfert, and other illustrious meteorologists. The result has been to make an enthusiast in this branch of science; and I hope with the assistance of this Society, to be able to carry on some useful work in Queensland in the investigation of the upper

air strata in sub-tropical regions. But of that I may have something to say at another time.

As a general result of my attendance at the Congresses mentioned, and at the Hamburg meeting of meteorologists, I would like to impress upon members of this Association (as it was impressed upon me) that we can in Queensland do an immense amount of useful work in the service of science, by placing on record the simple unpretending facts which we observe daily around us, and thus make our Journal a mine of wealth to those who are working out the great scientific problems of the day. I was amazed at the evidence of research disclosed in the reading of some unpretentious papers relating the results of patient observation extending over many years. And the papers of the leaders of thought showed in every line that their work was built on the observations of these humbler workers. One of the latter gentlemen said to me: "The exact record of an observation, however insignificant it may appear, may be of infinite value to a gifted individual who is following up a succession of similar phenomena." Therefore, I would ask the members of this Society to contribute such papers to our Journals as will make it a rich quarry for the scientist who requires reliable data concerning Queensland.

Oftentimes, the most interesting, and not the least useful fruits of travel are those which come to us unsought and unexpected. Such is the chance conversation with a fellow passenger on boat or train, the birdseye view of some foreign city from tower or mountain, the frequent comparison instinctively made between conditions at home and abroad, or the strange and sometimes incronguous literature coming to one in unfrequented paths. To all of these I was much indebted, and it may be well to lighten the hour of our evening's intercourse by pursuing some of the threads thus suggested to my mind rather than adhere strictly to the themes suggested by any recollections of scientific gatherings.

A most interesting comment upon much that I had seen in Italy, was furnished by the conversation of a Milanese barrister, whom it was my good fortune to meet whilst on the journey to Naples. He described most vividly the industrial rise of his country during the past decade. To this he had no doubt correctly attributed the marvellous prosperity which has recently given to the Italian Government a surplus of revenue for the first time within a quarter of a century—a surplus which one may suppose will be utterly extinguished by the terrible events which have overtaken Sicily and Southern Italy since the date of my visit. This industrial development my friend described as due in the main, to the fact that the returned Italian immigrants from America had brought with them

ideas as well as enterprise and money, and had started various manufacturing schemes throughout the whole of Italy, more particularly in the neighbourhood of Milan. These were now giving rise to a large export trade. As an example of this, it may be mentioned that practically the whole of the electric fans imported during last season into Australia and into South Africa have been of Italian manufacture, completing ousting the American, German, and English apparatus of the same description. One of the great factors in the industrial rise of Northern Italy has been the development of electrical power all along the southern flanks of the Alps, where for centuries past thousands of horse-power in the shape of waterfalls have been continually running to waste. Up to recent years, all industrial operations in Italy have been seriously hampered by the high price of steam coal which costs at the present time, delivered in Genoa from Cardiff or Swansea, from 30s. to 40s. per ton. That, of course, laid a heavy burden on the manufacturer; but the cheapness of electrical power has now removed the disability. In view of such facts, some have been disposed to despair of the future of British manufactures in the face of competition with Nature's own powerhouse; but as a matter of fact power has not yet been produced either in Switzerland or Italy any cheaper than it is in Lancashire and other coal districts of the British Islands. A similar statement may be made in favour of Australia, as we also enjoy the advantage of remarkably cheap coal.

There was another phase of Italian development that particularly interested me as a Britisher, not so much from the facts stated as from the parallel drawn between the present state of affairs in England and that from which Italy is just emerging. My friend, the barrister, reminded me that in the 15th and 16th century, Italy was the manufacturing country, *par excellence* of Europe, and her manufacturers and merchants accumulated immense wealth, which they lent out at usurious rates to the Princes of the surrounding countries. The large revenues which these Italian gentlemen derived from interest, gradually removed the necessity and stimulus for activity either in manufacturing or agriculture. Thus the land was allowed to go out of cultivation, and vast country estates were created for the enjoyment of those, who, having risen by manufacturing industry, now hated the very name of a factory, and desired to get as far away from everything of the kind as they possibly could. My friend shrewdly pointed out that the very processes which had destroyed the manufacturing vitality of Italy are now showing themselves in Great Britain, where the wealthy sons of great manufacturers of the last generation are buying vast estates and throwing the land

out of cultivation that it may serve them as reserves and parks, whilst they steadily abandon the industrial pursuits of their immediate ancestors.

One curious and by no means alluring feature of the Europe of to-day, as it presents itself to the visiting Australian, is the dominence of commercialism, as seen in the disfigurement of some of the most celebrated beauty spots by the erection of hideous advertisement hoardings. All round Lakes Como and Maggiore, for instance, the eye is offended by "posters" of gigantic size, advertising the most prosaic of commodities. In one instance, I saw an adversisement in letters at least 50 feet high desecrating the side of a mountain. Nearly every mountain top is accessible by means of funicular railways, scarcely any eminence of consequence being left in a state of nature. Indeed, the glory of mountain climbing, as we knew it in the last century, is practically a thing of the past. A strange reversal of the old order of things was noticed in London, where so far from disfiguring the beauties of nature, they are actually adorning the temporary scaffolding use in the erection of large buildings. Both at Whitehill and in Oxford Street, I noticed instances of this, and at one place a building in course of construction had been enclosed with a wooden colonnade, which gave it a decidedly classical appearance.

As was to be expected, the advent of self-propelled vehicles of various descriptions has given rise to numerous problems in the large centres of population. For one thing, the motor has been so destructive of roads, particularly since the adoption of steel-studded tyres, that the country surveyors and engineers responsible for the oversight or roads in England organised a Conference of Engineers last September for the purpose of devising means of overcoming the difficulty. The conference was held in Paris, and a highly valuable paper was read by the surveyor for the County of Kent, descriptive of the methods which he had found most effective; and this was received with great favour by those present. Generally he followed the principles of the macadamised road, combined with a very well thought out method of protection against the encroachment of moisture, the road surface being made practically waterproof.

The mention of motors naturally suggests the idea of the taximeter. In Paris, where the system has been in use for the past ten or twelve years, both horse-drawn vehicles and motors are all run on the taximeter plan—you pay according to distance, and you read your liability on the dial in front of you as the journey progresses. One curious fact is that in Paris, the system has proved so acceptable to the public that whereas formerly the cabmen spent much of their

time waiting for fares, now it is a matter of difficulty to get a vehicle, and ordinarily as you vacate your taxi-cab, there is another passenger waiting at the roadside to take your place. At the railway station, instead of seeing a row of cabs waiting to convey the passenger to his hotel one generally has to send a messenger out into the street to pick up one. In London the use of the taximeter system is confined to the motor-cab ; and so popular has it become that the ranks are filled with idle horse cabs. The unhappy cabmen attribute their misfortune to the greater popularity of the motor driven vehicle ; the experience of the Paris cabby has proved that this is not the case. Across the channel, it is just as difficult to get a horse cab as to get a motor cab, both are equally popular.

Whilst in Paris, I was greatly interested in a new type of dredge shown me as the invention of a Russian land-owner, who found it necessary to deepen certain streams in his estate, with a view of minimising the effects of flooding. It is now being developed for the purpose of ordinary dredging for the improvement of navigation ; to what extent it may prove adaptable to Australian conditions I must leave to the engineers charged with this particular interest. Briefly, it consists of a long spiral process of wood and steel, about six feet in diameter and varying in length from 100 feet to a quarter of a mile. The central axle is flexible, so as to adapt it to all inequalities, and it is rotated by the force of the current. The whole apparatus is sunk in the bed of the stream to be deepened, and anchored there in such a way that the revolutions of the spiral cut into the bed of the river. The silt being thus loosened is carried a certain distance before again finding lodgment, and as the process continues, it is eventually worked into deep water. It is said that so effective are the cutting edges of the machine that even submerged logs are severed and floated off. In rivers for which it is adapted this dredge has been found extremely cheap and effective ; but a current of at least three miles per hour is required. An experiment on a large scale is to be conducted with the machine this year in the sand-banks of the Loire, near the town of Nantes ; and the results should be well worth noting. The inventor states that the effect of the machine is to perfectly level the bed of the stream in which it is used. It is practically automatic, requiring the services only of a couple of men to attend to the moorings from time to time.

One thing that strikes every visitor to the Old Country is the marvellous way in which the great city of London continues to grow. During last year the attendance at the Exhibition was beyond all expectation, and the London hotels and boarding houses were crowded to overflowing from June right on to September, by which time

according to precedent, there should have been room and to spare in all directions. Travellers from distant parts were frequently unable to get accommodation, and I met a well-to-do New Yorker, who was quite unable on reaching London to get in anywhere, although he had telegraphed from Liverpool for quarters. After long search for a room, he was glad to spend the remainder of the night in his cab.

The Franco-British Exhibition was of course a great centre of interest for the visiting Australian.

From a geographical point of view, one of the most interesting features of the Exhibition was to be found in the large relief maps, many of which covered a couple of hundred square feet. These had been sent over by individual French towns, such as Havre and Marseilles—as an advertisement of their attractions and resources. They afforded practically a birdseye view of each city and its surroundings, streets, houses, and harbour works, and even the houses being depicted in a most striking manner. The only similar device I had previously seen was at the Christchurch Exhibition in 1906. On that occasion, the district of Taranaki had sent in a high relief map, showing mountains, rivers, forests and towns—portraying also the state schools, post offices, churches, and in fact every feature natural or artificial, likely to prove attractive to the intending settler.

One thing that engages the attention, especially of the Australian visitor to the Continental towns of Europe is the closely built arrangement of houses and streets. This is particularly the case in those countries where, until recently, the people have lived under the constant danger of invasion, and where it has been necessary to fortify the cities. This is apt to present itself to our minds as an unmixed evil, and would certainly be distasteful to our more spacious ideas, and in our warmer climate. But it has evidently its compensations ; for it found that the supply of public services, such as gas, water, electric light, and sewerage, are all carried out at a very low cost compared with what is necessary in Australia. It also affects the price of ordinary commodities, such as butcher's meat, bread and vegetables, because the purchaser in most instances carries home what is required, thus obviating the expense of delivery. Against this, however, it has to be remembered that in most Continental towns the cost of food is enormously enhanced by the fact that municipal revenues are chiefly derived from the octroi duties, levied on every particle of produce brought within the boundaries.

Even in British towns, there is much to make the Australian rejoice over his comparative freedom from taxation. A very undesir-

able state of affairs has in some cases been set up by the incidence of the poor relief taxation, which there falls upon the Parish and not upon the Central Government, as with us. In small towns with a mixed population of rich and poor, this does not lead to any extreme difficulty ; but in others, as in London itself where some of the Parishes are inhabited almost exclusively by the rich, and others exclusively by the poor, the inequality of the system is very marked. The rich Parishes have no expense on behalf of the destitute, who may be living in the next Parish, whilst the poor district has, out of its poverty, to do that which it has naturally the least means of doing. The rating in such instances rises to as much as 13s. in the £ of rental value ; and this has been an enormous burden on such enterprise as that of the railway companies, who may of necessity hold large areas in such a Parish for station yard purposes. This, indeed, has been one of the factors in the virtual panic which has set in with regard to railway investment, and to the enormous decline in share values as compared with what existed 10 or 15 years ago. So far as the loss of profits is concerned, this state of things has been due to a curious development in the habits of the people. To a very large degree the profit formerly earned by the suburban system, which formed an important element in railway income, has now been diverted to the underground tube railways, and to the electric tram systems which everywhere penetrate the suburban areas. At the same time, the growth of indebtedness of the local authorities, due to municipal trading, has combined with the operation of the poor laws to greatly increase the burden of taxation borne by the station lands. In order to compensate for the decreasing suburban revenue, companies like the Great Eastern have instituted a magnificent service of local trains, which convey passengers, morning and evening, from and to the neighbouring towns, such as Rumford and Chelmsford ; but so far the result has not been a financial success. From the very nature of the service, it involves the maintenance of a large quantity of rolling stock of an expensive description which can only be used for a few hours per day. Whole trains have to spend the best part of the day in the London station yards, awaiting the afternoon and evening traffic ; with the additional expense of having to greatly extend the area of the shunting yards, involving a corresponding increase in the payments, not only of interest, but also of local taxation, as already mentioned.

Another subject suggested by this line of observation is the complicated, not to say hazardous position brought about by the enormous increase in Municipal expenditure on public works and

utilities, chiefly from borrowed money. Time will not permit of going at all fully into this subject, but I may mention one or two facts brought under my notice. For instance, the city of Glasgow holds upwards of two million sterling, derived from small deposits, withdrawable at one month's notice. The whole of this money has been invested in Municipal works of various descriptions, from which, needless to say, it could not very readily be withdrawn should occasion require. Again, the Municipal Council of Edinburgh have advertised for short loans at a rate of interest, one-half per cent. above that given by the local banks. At the same time it must be conceded that the results of this large expenditure are so wonderful that it would be a sad thing to think that they should not be crowned with ultimate financial success.

In travelling in Europe, there are many things that astonish the Australian. The fact that every piece of land belongs to someone, and that there is no place where a billy fire could be lit, is most depressing. The settled way in which the people are divided into classes, and the small amount of transfers from one class to another, is a never-ending source of wonder to him. On the Continent, the most striking feature is the prevalence of militarism. Every town swarms with soldiers, and officers who bear quite a different appearance from the Tommy Atkins that we see sometimes. The continental soldier carries his full panoply with him, and as he swaggers down the street with a trailing cavalry sword, he is an object of fear as well as admiration. On the other hand, outdoor sports, as we know them, are not to be found outside of small areas which have come under the influence of the many small British Colonies which were to be found all over Europe some years ago to a greater extent than now.

On the other hand the physique of the people seems to have suffered less on the Continent than in England from the influences of modern civilization. In Germany there is actually an improvement in the matter of eyesight, compared with the condition of the people thirty years ago. I noticed fewer people wearing spectacles. This, I was told, is partly due to the increased use of the Latin writing in place of the German character, in books and letter-writing, a revolution caused by the introduction of the typewriter from America. In France the rarity of spectacled people was very striking, and the same remark applies to baldheaded men, and to the use of artificial teeth. The factory girls there are particularly fine looking and never wear any head-gear except on Sundays.

Fruit in season is cheap in Europe, but the season for each fruit is very short. As soon as the whole season is over, they depend on the oversea supplies of oranges and bananas.

THE BRITISH SOLOMON ISLANDS.*

By CLAUDE L. BERNAYS.

The story of the discovery, re-discovery, and final identification of the Solomon Islands is perhaps one of the most interesting and romantic episodes in the history of geographical research.

In 1567, Lope Garcia de Castro, then Governor of Peru, fitted out an expedition composed of two ships, the "Almiranta" and "Capitana," in order to seek for certain islands and a continent, which were supposed to lie many leagues to the westward. In command, he placed his nephew, Alvaro de Mendana, and as Chief Pilot or navigating officer, one Hernando Gallego. This Gallego, who appears to have been one of the Master-navigators of his time, had, some ten years previously, accompanied in similar capacity, an expedition sent to explore the newly-discovered straits of Magellan. An account of their voyage across the Pacific, though full of interest, hardly falls within the scope of this paper, so it will suffice to say that, eighty days after leaving Callao, the Spanish voyagers sighted land, to which they gave the name of Santa Ysabel, one of the largest of the Solomon Islands. Mendana, partly to induce his countrymen to colonise the newly-discovered land, and partly because he believed them to have been the source of King Solomon's wealth, named the group "The Isles of Solomon," and after spending some six months in exploration, returned to Peru after an absence of nearly two years. Twenty-six years later, Mendana, accompanied by Pedro Fernandez de Quiros as pilot, again set out in command of four ships, with the intention of colonising his recent discovery; but owing to the imperfect navigating knowledge at his command quite missed the Solomons, discovering instead the Santa Cruz Group. At a spot known as Graciosa Bay, an attempt was made to found a settlement, but mutiny, disease, and hostile natives all helped to make the little Colony a failure. After the death of their gallant leader Mendana, the survivors set sail for Manilla, which, after incredible hardships they reached. In 1605, de Quiros and Luis Vaez de Torres again set forth in quest of Santa Cruz and the Solomons, but failed to find either, discovering instead one of the northern New Hebrides, Espiritu Santo. Believing this to be part of the long sought for Southern Land, de Quiros, in his elation, named it Australia del Espiritu Santo. Here the voyagers parted, de Quiros returning

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to Mexico after vainly endeavouring to find Santa Cruz ; while Torres, after satisfying himself that the supposed continent was merely an island, continued his westerly course, and passing through Torres Straits, eventually reached Manilla. Nine years later, when the indomitable de Quiros was preparing to fit out yet another expedition, death overtook him, and so ended all his dreams of adding this great Southern Land to the territories of his Master, King Philip of Spain.

With the death of de Quiros, the very existence of Mendana's discoveries came to be regarded as a myth, and for two centuries the " Isles of Solomon " remained unvisited and unknown.

After a lapse of 170 years, Captain Carteret, in the " Swallow " re-discovered land which he identified as the Santa Cruz of Mendana, and continuing his course, sighted and named one of the outlying Solomons, Gower Island. Thus quite by chance, and quite without the knowledge of the English navigator, were the long lost Isles of Solomon found. In 1768, a French Admiral, Bougainville, came upon one of the Western Solomons, naming in turn the Islands of Choiseul and Bougainville. He also, misled perhaps by previous accounts as to their position, quitted the group in ignorance as to its identity. A few months later, de Surville, inflamed by rumours of " an island of great wealth and peopled by Jews," sailed from Pondicherry and eventually reached the island of Ysabel, where the Spaniards had landed 200 years before. Passing eastward, he sighted and named many of the Eastern Solomons. It is here interesting to note that, at the small island of Ulawa, the Spaniards came into conflict with the natives and in consequence named it La Treguada, because as Gallego observes, " they led us into a treacherous truce." Surville also was attacked at the same spot and beat his assailants off with grape-shot. For this and other reasons he named the group Terre des Arsacides, or the Land of the Assasins. Nineteen years elapsed before Lieutenant Shortland (in charge of a vessel conveying a number of transports from Port Jackson to England) coasted all the Southern side of the Group, giving to many of the headlands, islands, and peaks, names which still survive on modern charts. Under the impression that he was coasting along a continuous strip of land, he named it New Georgia, and continued his voyage without being acquainted with the nature of his discoveries, just as his predecessors, Bougainville and Surville had done. It was now left for the geographer to try and reconcile the conflicting statements of successive Spanish, French, and English navigators. The magnitude of this task may well be imagined when it is remembered that the jealous Spaniards fearing that some benefit might accrue to their sea-rivals, the Portuguese and the British, had purposely suppressed all accounts

of Mendana's voyages; and also, that Shortland had reported having coasted along a continuous piece of land. However, after much patient research, the new Georgia of Shortland, and La Terre des Arsacides of Surville were finally identified as the Isles of Solomon of Mendana.

From this time onward, the Group was visited by several officers bound homeward from Port Jackson via Java; Captain Manning, of the East India Company Service; Admiral D'Entrecasteaux, in 1792 and 3; and finally Dumont D'Urville, in 1838. Then followed in quick succession, traders in search of copra and beche-de-mer, the missionary, the whaler, and the labour vessel, till in 1896, in return for territorial concessions in Samoa, Germany ceded certain portions of the Group to Great Britain, and a British Protectorate was established all over islands east of Bougainville Straits.

Dr. Guppy in his work, "The Solomon Islands and their Natives," makes mention of the singular fatality attending the careers of French Commanders visiting these seas: "With the exception Bougainville, who lived to superintend, in 1804, the fitting out of a flotilla, at Boulogne, for the invasion of England, all died during the voyage or shortly after their return. La Perouse met with his untimely fate at Vanikoro, and neither of the two commanders of the expedition that was sent in search of him, survived the voyage; D'Entrecasteaux died from scurvy off New Britain, and Huon Kermadec died before the ships left New Caledonia. Lastly, D'Urville was killed in a railway accident in Paris, whilst still engaged in the completion of the narrative of his expedition."

The Solomon Islands are situated between the parallels of 5 and 11 South Latitude, and the meridians of 154 and 163 East Longtitude, and extend for nearly 600 miles in a south-easterly and north-westerly direction. The British portion, with which I propose to deal, comprises six large islands, San Christoval, Malaita, Guadalcanar, Ysabel, Choiseul, New Georgia, and numerous smaller reefs and islets, estimated to contain an area of 15,000 square miles. The islands are for the most part clad in the densest of tropical jungle, extending from the summits of their mountains, down to the very water's edge, broken here and there by clearings where the natives have planted their patches of yams and potatoes. Of the mountains, Mount Lammas, on the island of Gaudalcanar, attains a height of 8,000 feet, and Lion's Head (a few miles to the eastward) 5,500 feet.

Except on the island of Bougainville (German Territory) there are no active volcanoes in the Group, although a volcano on the small island of Savo is known to have been at least twice in eruption;

first in 1567, during the Spanish visit, and about the year 1834. The island, however, abounds in hot springs, sulphur beds, and pools of bubbling mud, and though the original crater has long since become overgrown with ferns and brushwood, there is every likelihood of it breaking out once again. Two malignant " spirits " are supposed by the local natives to inhabit the crater, and so long as they are not annoyed, Savo will remain quiescent, but apparently little reliance is placed on their goodwill, for the inhabitants are at all times ready to flee if the volcano shows the slightest signs of activity. Earthquake shocks are by no means infrequent throughout the Group.

CLIMATE.

The climate of the Solomons can hardly be characterised as healthy, malaria is very prevalent ; but by paying due attention to the selection of a site for a residence ; waging perpetual war on mosquitoes and their breeding pools ; and the judicious use of quinine, as a febrifuge, white residents obtain a certain degree of freedom from its attacks.

In these latitudes, the prevailing winds are naturally the South East Trade and the North West Monsoon. Towards the end of April or the beginning of May, the Trade Wind's arrival is heralded by unsettled weather and frequent squalls and thunderstorms. Often, the month of May will produce only light and variable airs, but by June the south-easter has begun to blow with steady fury, and continues without interruption up till the end of November. In December, the enervating influence of the north-west monsoon begins to make itself felt, and then ensues a period of fierce west and north-west gales alternating with dead calms and light airs. Luckily, the Solomons are beyond the influence of the hurricanes which periodically devastate the coast of Queensland, and the islands further south and east. As so few permanent records have been kept, it is impossible to do more than estimate the coastal rainfall. However, in setting it down at between 100 and 150 inches per annum one would be quite within the mark. Dr. Guppy estimates the fall among the mountains of Guadalcanar, to be between 400 and 500 inches annually. Enormous as the fall may seem, it is quite to be believed when one sees rivers like the Beraude, Balesuna, and Bokakimbo (on the eastern slope of this island) rise 15 to 20 feet, inunduate the surrounding lowlands and subside again, all within a single night. Usually, these streams are shallow torrents, but in times of flood they often carry a volume of fresh water 3 or 4 miles out to sea. The temperature ranges between 76 and 90 F.

INHABITANTS.

The inhabitants of these islands are of the true Melanesian type, varying in colour from a light brown to a black and of an average height of 5 feet 4 inches. It is indeed interesting to observe the changes of type in travelling from east to west. Amongst the Eastern Solomons one meets with squat, thick set natives of a light brown colour; further West, the colour becomes darker but with little appreciable increase in stature; but on the extreme West, more especially in the islands of Bougainville Straits, the inhabitants are distinctly taller, more robust and with jet black skins. It is here interesting to note the presence of two small groups inhabited by Polynesians, namely the Stewart Islands and Rennel Islands, each lying within 100 miles of the Solomons, but there appears to be no communication between them and their Melanesian neighbours. The Stewart Islands are visited by occasional trading vessels, but so far, the Rennel Islands have remained practically untouched, and it is highly probable that many "finds" await the botanist or naturalist who cares to make a systematic examination. Owing to the fact that so large a percentage of the inhabitants is to be found in the bush, no reliable estimate can be made as to their numbers. Estimates as to the population of the island of Malaita vary between 20,000 and 100,000, but the very difference of these figures is, in itself, proof that nothing definite is known on the subject. Gallego speaks of having been attacked at different times by bodies of natives numbering from 200 to 3,000; but even after allowing a handsome margin for exaggeration, parties of such size are rarely, if ever to be seen in these days. Excepting, perhaps, on Malaita the population is slowly, but nevertheless surely, on the decrease, the main causes being pulmonary and enteric affections as well as the practice of infanticide and foeticide. The island of Malaita is by far the most interesting of the many islands of the group. For years it was a favourite recruiting ground for vessels engaged in the Queensland, Fijian, and Samoan labour trade, and at the present day supplies practically all the labour used on the local plantations. When so many of the male population have come into contact with the white man, one naturally expects to find a more settled and civilised community. It cannot, however, be truthfully said that such is the case; in the majority of instances, a few years residence in Queensland has given the Malaita man an exaggerated idea of his own value, and without acquiring many of the white man's virtues he has taken care to absorb all his vices.

While on the subject of Malaita, I cannot refrain from referring to a subject which should be of interest to Queenslanders. When

it became generally known that all " Kanakas " (?) were to be deported from Queensland, a great deal was written (generally by persons ignorant of or only partially acquainted with the position) as to the danger attendant on forcibly deporting these people to their homes. I happened to be on board a 100 ton Auxiliary Schooner engaged in returning the first batch of Malaita natives to their respective villages, and can testify to the extreme care (under strict Government supervision) with which their repatriation was conducted. In no instance was a native forced to land at any particular spot, and if any doubt existed as to his reception, he had the option of either being landed at a village where his safety was assured, or of going ashore at a mission station where he was always welcome. The influx of 2,000 natives, many with considerable sums of money or well filled boxes in their possession, had naturally, a disturbing effect on the resident population, but of danger to the " return " there was absolutely none, unless, of course he himself chose to make trouble. On the East coast of Malaita, a curious state of affairs is met with ; I refer to a collection of tiny reefs and islets literally teeming with people. To appreciate the necessity for such peculiar dwellings, one must understand that between the bush and coastal tribes (or " salt water " men, as they are called) there exists a perpetual feud. In bygone days the " saltwater " natives lived on the coast of the main land, but found that no sooner had they cleared a patch of ground and planted their gardens, than the bush tribes descended upon them, burning their villages and laying waste their plantations. In consequence, they were forced to abandon their homes on the mainland and seek refuge elsewhere. Any barren reef, provided it was above high water mark, appears to have been utilised, and by carefully packing coral boulders and drift logs, a fairly presentable artificial islands have resulted. To these somewhat unstable homes, the harassed salt water men have retired, and building their thatched houses so closely that a pig can scarcely pass between, they live in comparative security. Many of these artificial islands are surrounded by coral walls, pierced here and there by narrow embrasures, permitting only 2 or 3 canoes to pass in abreast. As no vegetable food can be grown on these tiny islands, the inhabitants have been forced to cry " pax " with their bush enemies, so at stated intervals markets are held on the mainland. On such occasions, the bushmen arrive with yams, sweet potatoes, nuts and uninviting-looking taro to exchange for the fish, tobacco, and shell money of their salt water neighbours. The bargaining is all done by women, while the men (who have come fully armed) stand by with ready weapons in case of attack. On market days, hostilities cease by

mutual consent, and to their credit let it be said that the truce is seldom broken.

HOUSES.

The dwelling of the Solomon Islander is usally nothing more than a framework of bamboo thatched with leaves of a species of sago palm. The sides are low and generally of the same material as the roof. A narrow aperture 2 or 3 feet from the ground affords the one means of entrance or exit and as this is, as a rule, the only opening, the interior of the average house is in a state of semi-darkness. In the olden times when the Western head hunters used to descend on the island Ysabel, the villagers, to guard against surprise, hit upon the happy expedient of building platforms high up amongst the branches of trees, and retiring thence at night. An account of the Solomon Islander's dwelling would hardly be complete without mention of that peculiar institution the "tambu house." Its uses are many and various, but first and foremost it is the village club-house; it is here that the men, young and old, meet to exchange news, discuss the events of the day, and lay plans for the morrow. If by any chance you have business to transact with any particular native, go to the "tambu house" towards sunset, and surely you will find him there, smoking, chewing betel-nut, or gossiping with his friends. No women are allowed within its sacred precincts, and they must always pass at a respectable distance behind, and never in front of the house. However ill-furnished a village may be in the matter of dwellings, one will invariably find the greatest care lavished on the erection of a "tambu house." The timber is carefully selected; the thatch well sewn and closely laid; while the posts supporting the ridge pole are frequently grotesquely carved to represent men, fish or birds. In the Eastern Solomons, the "tambu house" is used as a store-house for large canoes, and as a mark of especial favour, the chief is allowed to place his own canoe therein. Amongst certain tribes, the custom prevails of exhuming the body of a chief and placing his bones and skull in a wooden receptacle slung from the rafters of a village "tambu house"; only the skull of lesser personages are thus honoured. Visitors or strangers in a village are always accommodated in the "tambu house," and no one seems to object to sleeping cheek by jowl with the remains of departed warriors. On one occasion I endeavoured to pass a night in a "tambu house" on the island of San Christoval, where the exhumation of the honoured dead must have been a trifle premature, and though my companions seemed not in the least disturbed, I decided strongly in favour of the fresh air and spent the remainder of the night fighting mosquitoes on the beach. The completion of one of these houses is usually celebrated

by feasts and dances lasting many days, and formerly, by the sacrifice of some unfortunate slave either purchased or taken captive in a raid.

FOOD, ETC.

The Solomon Islander is by no means hard pressed to obtain the necessaries wherewith to support life, and as a consequence his efforts as an agriculturist are somewhat meagre. His diet is to a great extent vegetable, and a bounteous Nature supplies (without effort on his part) so many of his needs, that he might even dispense with the labour of clearing and planting a garden. With so much land at his command, he is able to select the most fertile spots in a very fertile country, and the rest is easy. The bush is felled and roughly burnt off ; yams are planted and trained over stakes ; a few sweet potatoes and panas (a small floury and somewhat tasteless potato) ; possibly 30 or 40 banana suckers ; a little sugarcane, and his plantation is complete. Beyond an occasional weeding and swathing the young banana bunches in grass as protection against parrots and cockatoos, no further attention is paid to the garden until the crops attain maturity. I may mention that practically all work, from felling the timber to gathering the crop is done by women. The male Solomon Islander quite recognises the "dignity of labour" for someone else, and provided he has ample food, a sufficiency of tobacco to smoke and betel-nut to chew, he is quite content that his women-kind should toil to provide them. On the larger islands, where every man has acres of land at his disposal, only one, or possibly two crops are grown on the same piece of land. The old garden will be abandoned, a new piece felled, and in a years' time all traces of the original clearing will be obliterated by the ever-encroaching bush. Of the numerous edible nuts, fruits and vegetables to be found growing wild in the bush, the "nali" or native almond is probably of most importance to the natives. This is the product of a gigantic tree (Canarium Commune) with a purple fleshy envelope, oval in shape and from 2 to 3 inches long. The kernel which is of triangular form, somewhat resembles an almond, and is much esteemed by the natives. When pounded and mixed with grated cocoanut and taro, it is baked in leaves and forms a very palatable and sustaining pudding. Unlike their neighbours the Papuans, the Solomon Islanders manufacture comparatively little sago, although, throughout the entire group, large groves of a species of sago-palm are met with. This noble palm, which attains a height of from 70 to 80 feet, is locally known as the "ivory nut," and yields large quantities of a small hard nut formerly much in request for the manufacture of buttons and imitation ivory goods. I have observed

the preparation of sago at one spot only, the island of Treasure in Bougainville Straits ; here the palm is felled, the pith extracted, washed, strained, and the resultant sago dried. Elsewhere the pitch is cut into oblong blocks, dried and stored till such time as provisions are required in compact and portable form. Mention may also be made of the "taro" (which, though growing wild, is occasionally cultivated), bread fruit, paw-paw, and a small fibrous mango. The filthy practice of chewing betel-nut prevails throughout the Solomons, accompanied, of course, by the usual pepper leaf and lime. The betel-nut, which is used by both men and women, has a distinctly stimulating effect, but apparently no evil results from its habitual use. Fish, fresh-water prawns, turtle, opossums, shell fish (especially the giant clam) and of course the pig, supply the inhabitants with the animal portion of their diet, whilst among certain tribes even the flesh of sharks and crocodiles is not despised. Mention may here be made of a novel method of fishing which prevails on the island of Florida. A leaf kite is flown from the stern of a canoe,. but a fishing line just touching the water, replaces the usual tail. Instead of a hook, a ball of stout cobweb is fastened in its place, and as the fiisherman paddles slowly ahead, the kite's action whisks the bait along the surface of the water. Fish (generally a large variety of gar) doubtless mistaking the jumping cobweb for their usual dietary of small fry, bite and immediately their teeth and snout become entangled in the cobweb. The practice of stupefying fish by means of "oap." or other vegetable poisons, as used by the natives of Micronesia and other Pacific Groups, does not seem to be in general use throughout the Solomons, the natives, perforce, having to employ the more sportsman-like methods of procuring their fish-supply. The use of dynamite is, of course, prohibited amongst them, though one occasionally meets with natives minus a hand or arm, reminders of the days when this dangerous explosive was a staple article of trade.

WEAPONS, ETC.

Spears, bows and arrows, clubs and tomahawks are the only offensive weapons used by the Solomon Islander, the shape and pattern of each varying very greatly on different islands. Amongst the Eastern Islanders, the spear, club and tomahawk, appear most frequently, whereas in the Western Solomons, bows and arrows, as well as spears, seem to be the favourite weapons. The San Christoval spears are usally from 7 to 10 feet long, manufactured from a hard, dark wood, with blunt points, undecorated and destitute of barbs except those roughly carved on the head of the spear itself. This may not appear to be a very dangerous weapon, but in the hands

of a warrior aiming for his antagonist's abdomen, one imagines it would prove a very effective means of defence or offence. Throughout the Western Solomons, however, a much more ornate and formidable variety of spear is in use, with ten or a dozen projecting bone barbs, the spear head is dyed and elaborately carved, and occasionally the entire shaft is covered with bands of coloured "grass," neatly plaited into a variety of patterns. From the island of Guadalcanar, however, comes a spear which can have few equals among the implements of primitive warfare. This fearful weapon is fashioned from the human tibia (or femur), and has often as many as fifteen delicate, needle-like points cut from the surrounding bone. Before being affixed to its shaft the head is steeped in putrefying flesh, and this process is considered by many to invest such a spear with the power of transmitting tetanus. Emphatic as the natives are in declaring that a person wounded by such a spear must surely die, it seems unlikely that the mere fact of soaking the head in putrefying matter would cause this result. Possibly the mixture of lime, earth, etc., with which the points are coated may be the vehicle by which tetanus is conveyed. When not in use, these spears are carefully protected by a bamboo cap to preserve their fragile tips. Fortunately, the manufacture of these weapons has of late fallen into disuse, and perfect specimens are rarely met with. The Solomon Islander is by no means an expert with the spear, and compared with the Australian aboriginal, he is a decidedly poor performer. Unlike the latter, he uses no throwing stick or other aid, so consequently at the longer ranges his aim in distinctly erratic. The bow, as used by the Western natives, is from 6 to 7 feet long, stoutly made, and heavily corded; the arrow 4 to 5 feet in length, and usually lacking barbs. Up to a distance of say, 30 or 40 paces a native is able to make fairly good practice, but owing to the absence of feathers and length of the arrow, their shooting at greater ranges is not to be relied on. Clubs vary so greatly in shape and size, that a detailed description is hardly possible; the most notable, however, are the long-handled, crescent-shaped clubs of San Christoval, and the short, but none the less effective, diamond-headed weapons used by the natives of Malaita. The tomahawk, which dates from the advent of the white trader, is merely a light steel blade, fitted to a 5 foot handle.

WARFARE.

Their methods of warfare are essentially those suggested by treacherous cunning, and two tribes are never known to meet in hand to hand conflict, reliance being placed mainly on the completeness

of a surpirse, or the success of an ambush. In their raids, it is customary to steal upon and surround an unsuspecting village, and to make the attack just before dawn. If perchance, a watchful dog alarms the sleeping settlement just in time, the contest develops into a race to determine who can escape most quickly. Another method is for a number to ambush a party of women at work in their gardens. In either case the odds must be enormously in favour of the attackers, or the expedition is never undertaken; and no matter how successful the raid may be, the casualties are few, the damage slight, and the so-called "massacres" one reads of, non-existent. The days when large head-hunting parties could descend and obliterate an entire village have happily passed away, and the luxury of slaughtering their neighbours is now permitted only to a few tribes who, by virtue of their isolated and inaccessible positions are beyond the reach of a vigilant government. There can be little doubt that, for various reasons, the native population is slowly decreasing, but inter-tribal warfare cannot fairly be regarded as a contributing cause. Occasional "scare" paragraphs appear in the Australian Press (inspired, usually by tourists who have spent a fortnight in the group) dealing with the likelihood of a concerted rising by natives against the white settlers. The utter absurdity of such statements becomes apparent when one considers, not only the infrequency and difficulty of inter-insular communication, but also the fact that tribes living only a few miles apart on the same island are found to speak totally different dialects. Even if the slanders had not their own petty troubles to engage their attention, the possibilities of a united rising against the white residents is extremely remote.

NATIVE MONEY.

Like most uncivilised races, the natives of the Solomon Islands have chosen the most durable, and at the same time most valuable articles wherefrom to manufacture their money. The inhabitants of certain Malaita reef islands, principally the villages of Langa Langa and Auki, are the "coiners" of the group, and it is here that practically the entire supply of the much prized Red Shell Money is made. A brief description of the various processes through which this money passes may not be out of place. The shell itself is of the "Chama Pacifica" variety, small and ear-shaped, coloured a brilliant crimson on the outside edge of the lip, and shading away to a delicate pink, and finally white at its base. It is found in depths varying from 2 to 10 fathoms, and it is probably the difficulty of first securing the shell, added to the subsequent laborious processes of drilling

and trimming down, which renders this money so valuable in a native's eyes. An elaborate ceremony precedes the diving, each diver making burnt offering to his own particular "devil" to safeguard him against danger from sharks and the deafness which eventually inflicts itself on men who are constantly engaged in this occupation. After a sufficient quantity of shell has been raised, it is handed over to women, who remove the shell-fish and spread it out to dry in the sun. From thence it passes into the hands of men who chip away the outer crimson rim with hard flint hammers. From this particular portion of the shell, the most valuable money is derived; the inner and less brilliantly coloured parts furnish a larger and coarser variety. These fragments have now to be cut into minute flat discs about $\frac{1}{8}$th of an inch in diameter, each pierced by a small hole. This is done with a very ingenious tool, tipped with chalcedony, and somewhat resembling an Archimedian drill in appearance and action. Each disc has then to be ground flat and into symmetrical circular form, so that when strung with others it will lie closely against its neighbour. Finally, the finished discs are threaded on lengths of fibre, each a fathom long; each fathom being divided into three parts by short sections of black and white discs, the finished article being worth from 2s. to 20s. per fathom according to quality. From 1,000 to 1,200 discs are required to complete a length, and in a well made fathom these will not vary a hair's breadth in diameter or circumference. I am unable to say what time is consumed in making a fathom, but after watching a single disc in the course of manufacture, I could not but admire the worker's infinite patience and hope that he would derive full benefit from his labour. The actual cutting of the shell is done in secluded houses, the workers being "tambu" (that is, sacred) for the time being, and may not have intercourse with others until their task is completed. A Malaita man will only part with this precious money when he has absolutely nothing else to sell, and then only in as small quantities as possible. A somewhat similar money made from white shells passes as currency in certain parts of the Group, but its use is confined to small districts, and it has a trifling value. From Malaita, again comes another important item in the native currency, namely porpoise teeth. At certain seasons of the year, when these fish approach the coast in large "schools," organised porpoise "drives" take place. A fleet of canoes put to sea, and by careful manœuvring surrounds a shoal of porpoises close in shore; by gradually narrowing the circle, and at the same time making as much noise as possible, beating the water with their paddles, and yelling in unison, the frightened fish are eventually driven

into shallow water and stranded. A full grown porpoise will yield about 100 teeth, valued at, roughly, a penny each. In several districts in Malaita the porpoise is deified, and although the natives will not themselves kill or eat a porpoise, they have no objection to using the teeth of their guardian Deity as money. These " randi," as they are called, are used mainly by the natives of Guadalcanar and Florida, who pierce and weave them into a variety of ornaments. On fete days it is no uncommon sight to see a native wearing all his available wealth in the form of a collar, belt, or bracelet of porpoise teeth. The teeth of dogs and flying foxes are used for the same purposes. Further west, the coinage, excepting the Red Shell Money, changes entirely, and the teeth so much prized by the eastern islanders have practically no value. Their places are supplied by shell arm rings cut from the thickest portions of the giant clam and the teeth of sperm whales. The manufacture of one of these shell rings calls for a greater expenditure of time and labour than even a fathom of shell money as previously described. The clam shell is of adamantine hardness, and with their primitive methods of drilling and sawing, the initial process of boring and cutting out the rough disc is an extremely tedious one. This accomplished, the real work has yet to be done, a shapeless lump of shell two inches thick, and some six inches across, has to be ground down to a narrow band varying from one half to three-quarters of an inch in width, and three inches in diameter. Very frequently, as the ring is nearing completion, the unfortunate worker may discover a flaw which reduces the value of his armlet fully one half. The number of such rings usually indicates the status and wealth of the wearer. The whales teeth are unwieldy masses of ivory weighing from 2 to 3 ℔s., and needless to say are not used as ornaments, but are carefully buried until such time as their proud owner has need of them.

CANOES.

The canoes of these islands may be divided into three classes the " Dug-out," the " Outrigger." and the " Planked " canoe. The " Dug-out " is rarely met with, except in certain sheltered harbours and rivers. It is a rude and quite unseaworthy craft, roughly hollowed from a log of soft, white wood. Treasury Island furnishes, perhaps, the best example of the " Outrigger " canoe. These vary from 15 to 20 feet long, neatly hollowed from a single trunk, and so narrow that the occupant sits on a plank supported by the gunwales with only his feet and legs inside the canoe. A single mast is stepped almost in the bows, and on light bamboo spars these diminutive craft display a truly enormous spread of sail ; a 20 foot canoe having

frequently a boom projecting 10 feet, or more, over the stern. They are steered by means of a broad-bladed paddle, shifted from side to side as the occasion demands. So long as the "outrigger" is to leeward, there is little danger of capsizing, but when to windward, the steersman must be constantly on the alert, as an extra strong puff will lift his "outrigger" clean out of the water, and a second later he will be struggling to clear himself from the wreckage. On a fresh south-easterly day, the harbour of Treasury presents one of the most delightful sights imaginable, hundreds of the small craft flitting to and fro, running down and beating back up the harbour, each handled to perfection by its owner. I was once tempted to accompany, as passenger, a small youth, who prided himself upon possessing the only canoe in Treasury which carried a topsail. Running before the wind was uneventful and pleasant, but the return journey was productive of some exciting experiences. Frequently, another canoe would surge across our bows, apparently with every intention of running us down, and just as the crash seemed imminent, my small steersman would, with a quick flirt of his paddle, throw us up into the wind, and without losing an inch or wasting a second, career off on the other tack. When our position brought the outrigger to windward, I was peremptorily ordered to crawl out on the quivering bamboo staging by which the outrigger is attached, and by my weight allow the sheets to be hauled in and a better tack made. On returning to the ship, my companion volunteered for a consideration of three sticks of tobacco, to take me out again next day, provided the wind was more big (that is stronger). I paid the tobacco, but declined his invitation, whereat he departed, highly disgusted that I failed to appreciate the honour of sailing with him in his "only canoe with a topsail." Without attempting to estimate the speed these canoes attain, I may say that I have seen them outsail a 50 ton schooner running with all sail set before a fresh breeze. Planked canoes are in general use throughout the group from east to west, and vary little in appearance. The western "Tomakos" or fighting canoes, afford the best examples of the canoe builder's labours, both in construction and decoration. In building them, a V-shaped keel with grooves cut in its upper edge, is first prepared and laid. The timbers forming the sides (three or four in number) are now built up from this keel, each plank being grooved to receive its neighbour. Along each seam a series of small holes are bored, through which lashings of cane are passed and securely fastened. The entire seam is then plentifully plastered with a kind of resin derived from the kernel of the "Teeta" nut (Parinarium laurinum) which hardens in a few hours, thus making the seams water tight. The bow and

stern are continued upwards to a height of fifteen feet, giving the canoe somewhat the appearance of a Venetian Gondola. At first sight these continuations appear rather useless appendages, but two early navigators, Bougainville and Surville, furnished explanations as to their use, which is, that when the canoe is turned end on towards an advancing enemy, the high prow affords shelter against arrows and other missiles. Inside, the canoe is strengthened by the addition of carved knees lashed to projections left in the planking. Considerable care is expended on external decoration; the sides are inlaid with regular patterns consisting of squares, triangles, or circles of pearl and other shells, while to the stem and stern are attached strings of large white cowries surmounted either by a plume of feathers, or a tuft of dried grass. At the bows, close to the water line, is lashed a grotesquely carved wooden head, supposed by the superstitious natives to give warning of sunken rocks, or an approaching enemy. Large canoes of this description, containing as many as 40 men, occasionally make long journeys between island and island, having to cross considerable stretches of open water exposed to the full force of the wind. They are propelled almost entirely by paddles, sails being rarely used.

RELIGIOUS OBSERVANCES AND SUPERSTITIONS.

Any knowledge of the Solomon Islanders' religion, or rather lack of religion, and the numerous superstitious observances by which his life is governed, can only be acquired by one who has lived for years amongst them, and has so far gained their confidence as to overcome their natural reluctance to speak freely of things "tambu." The "tambu" ban with its far-reaching effects, plays an important part in a native's life. If perchance, he has a patch of taro, or a grove of betel-nut he desires to preserve exclusively for his own use, he has simply to surround it by the flimsiest of fences, and at some prominent spot attach his own particular "tambu," possibly only a bunch of scented leaves or dried grass. The consequences attendant on breaking this "tambu," though generally not specified, are sufficiently dreadful (in the native's eye) to act as a deterrent. Again, the "tambu" will be placed on a man who had committed some offence against tribal law. This would prevent his returning, and a reappearance would probably mean death. Instances such as these might be multiplied indefinitely. The flesh of a crocodile, shark, and porpoise are forbidden luxuries with certain tribes, whilst among others these dainties are highly esteemed; but so strict is the observance, that a native to whom shark flesh is forbidden, will refuse to eat other food cooked in the same vessels or over the same

fire. Evil spirits, capable of bringing sickness or death upon those who offend them, are supposed to inhabit certain localities, notably the extinct crater on the island of Savo, previously referred to. The belief in a future state is exemplified in many instances. On parts of San Christoval the dead are supposed to enter into fire flies, and if one of those insects enters a house, the inhabitants immediately desert it. The Island of Malapa, lying off Marau Sound, is believed to be the "Ghost Land," where the spirits of the dead congregate until such times as their respective bodies may rejoin them. Again, in certain parts, both sharks and porpoises are credited with being the receptacles which receive the dead. In the case of the shark, this is literally true, as in places where the superstition prevails, burial takes place at sea, and no doubt sharks play an important part in the disposal of the bodies. The natives of Treasury believe in the existence of a benevolent spirit living in a pleasant land, whither all men who have led reputable lives, go after death; a veritable Lotus Land where all things are made easy, abundant food and betel-nut, and above all, what appeals most to the native mind—no work. On the contrary, men who have led bad lives, are transported to the crater of a volcano on Bougainville, the abode of an Evil Spirit and his companions. The "sorcerer," who combines the professions of rain-maker and wind prophet, is an elaborate humbug much feared and respected by those who still believe in him. His methods very much resemble those of a gambler with a double-headed coin, in so much that even if his prophecies fail to come true, he stands to lose nothing either in fees or prestige. For instance, a garden may just have been planted, and rain is needed to help the young crops. The wizard is consulted, and for a consideration undertakes to provide rain by a given date; the day arrives but no rain; the sorcerer is again consulted, but calmly informs his anxious inquirers that one of their number has insulted the "Rain-God," who is angry, and has refused to send rain. He volunteers, however—always for a consideration—to not only find out the culprit, but to propitiate the offended Deity. Again, a party wish to go on a canoe journey, so the sorcerer is paid to assure fair weather for the undertaking; the day arrives, but with a strong head wind. "Of course," says the prophet serenely, when the disappointed voyagers come to demand their money back, "how could it be otherwise when one of you has offended the "Wind-God." And, again the superstitious gulls are persuaded to pay yet another fee to soothe the outraged feelings of the "Wind-God." However, let there be a few successful guesses and much wealth and a wide reputation, will reward the sorcerer's labours. Without doubt the sorcerer's profession is a safe and decidedly

lucrative one, paying almost as well in its way, as do the efforts of similar charlatans who infest and batten on many a more civilised community.

In the foregoing I have endeavoured to give a brief but naturally incomplete account of these little known islands and their inhabitants, and cannot more fitly conclude than by referring to the agricultural and other possibilities of the group. Of the huge area of rich land available for cultivation, only some 12,000 (?) acres have been planted up to date, mainly in cocoa-nuts, rubber, cotton, and fibres. The timber resources are practically unexploited, and an untouched country awaits the prospector's hand. However, each year brings fresh settlers, larger areas are opened up, and in the future the Solomons give promise of becoming a second, but infinitely richer edition of Ceylon.

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BLACKS AS FISHERMEN.*

EXPEDIENTS, DEVICES, STRATAGEMS.

(With Seven Illustrations.)

By E. J. BANFIELD, J.P.

Along the coast of North Queensland evidence may still be obtained, though it ever becomes more difficult to secure practical demonstration, of several novel methods of killing fish in vogue among the blacks prior to the advent of civilisation. In many parts, indeed, the presence of the white man has swept away not only the use of decent, if trivial, pursuits and handicrafts, but the knowledge also that they ever existed.

The few facts here presented are, with some slight reservations, drawn from actual observation. No doubt the well-informed on such subjects will have plenary reasons—if ever these lines are honoured by perusal of the class—for the accusation that there is nothing in them having the virtue of newness or novelty. But I am not a professor with a mind like a warehouse, rich with the spoils of time, but a mere peddler, conscious of the janglings of an ill-sorted, ill-packed knapsack of unconsidered trifles.

Some pioneers know more about the acts of the past than the best informed of the younger blacks, who look with wonder and unconstrained doubt when shown articles similar to those which their grandfathers must have used almost every day. An apt illustration to this statement of fact was given a few months ago. Anxious for confirmation as to the particular kind of fish hook used by the blacks in comparatively recent times at a certain point on the coast of Cape York Peninsula, I was glad of the opportunity a chance visit of a beche-de-mer lugger afforded of furthering the inquiry. Four of the crew were natives of the part, but only one had ever before left "Home." Under the rays of untarnished testimony, an enlightening glance at the past seemed possible. The travelled boy was an old acquaintance who, though very indifferent in his pronunciation of English, understood enough to maintain a generally intelligible conversation.

"Fish-hook ! What kind you fella, belonga you country ? "

"Byd-em that kind."

"Byd-em," I repeated. "No savee that talk."

"Yes," reiterated the boy. "Byd-em that kind."

Hooks shaped after the fashion of a bird's claw had been seen in use in one locality, and associating the broad sound "Byd" with "Bird" light appeared to glimmer along two divergent tracks—

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the one leading to the incident which had excited curiosity, and the other towards the origin of the affected enunciation of certain youthful white Australians who are given to the pouring of contempt on their coloured countrymen. It was an entirely false flare, as the sequence proved.

"How you fella make 'em that kind of fish hook?"

Again came the insipid repetition of the compound word, "Byd-em that kind."

Then one of the untravelled boys came to set the cross-purposes straight. "Mattie. He no talk good fella. That fish hook i-een. Me fella bi-em along store."

Thus expounded, the fact came out, that the blacks of the district bought ordinary fish hooks, and had no knowledge of the use of any other kind, whether of pearl or tortoise shell. When shown samples of the former they were frankly incredulous, asserting that the only way of killing fish other than with "i-een" hooks was with the spear. In the assurance of provincial ignorance they giggled at the suggestion that fish could be caught with shell hooks. "No good that fella; carn catch-'em fish," was the unanimous and dogmatic opinion.

A gentleman who works among the blacks with rare self-sacrifice, and no love of notoriety, though much to the betterment of the race, and whose field of operation is but little removed from the country of these boys, tells me that in his locality hooks do not seem to have been used, spears and nets being relied upon for securing fish.

TRAPS AND STRATAGEMS.

"First zettle the pralimbinaries," quoth good farmer Snowe
"First zettle the pralimbinaries, and let's to business."

Though the blacks of the past had but casual knowledge of the cruel little barb that the resourceful white fisherman finds essential to sport, and had neither neat tackle, nor reels, nor creels; no, nor even the solace of tobacco, or any other accessory was theirs, they were adepts at fishing. They had at command a stock of accumulated lore so graphically transmitted, that the babe and suckling must have seemed to acquire it almost intuitively. They knew much of the habits of fish. Their methods of laying under tribute the harvest of the sea were so varied and unconventional, that when one expedient failed, others equally free from the ethics of sport were available at the shortest notice. Fishing was not a pastime, but a serious occupation in which nearly every one was proficient.

Times are changing, but still the mouths of smaller creeks are sometimes dammed, save for certain sluices and bye-washes where puzzling pockets are set. Weirs formed by stakes driven into the

sand and interwoven with twigs guide incoming fish into ingenious traps, whence they are scooped up in dilly bags. Occasionally the whole camp, dogs and pickaninnies included, take part in a raid upon the sea. Men in the deeper water, women and boys and girls forming wings at right angles to the beach, enclose a prescribed area in an ever-shifting mobile fence. Certain of the men have huge dilly

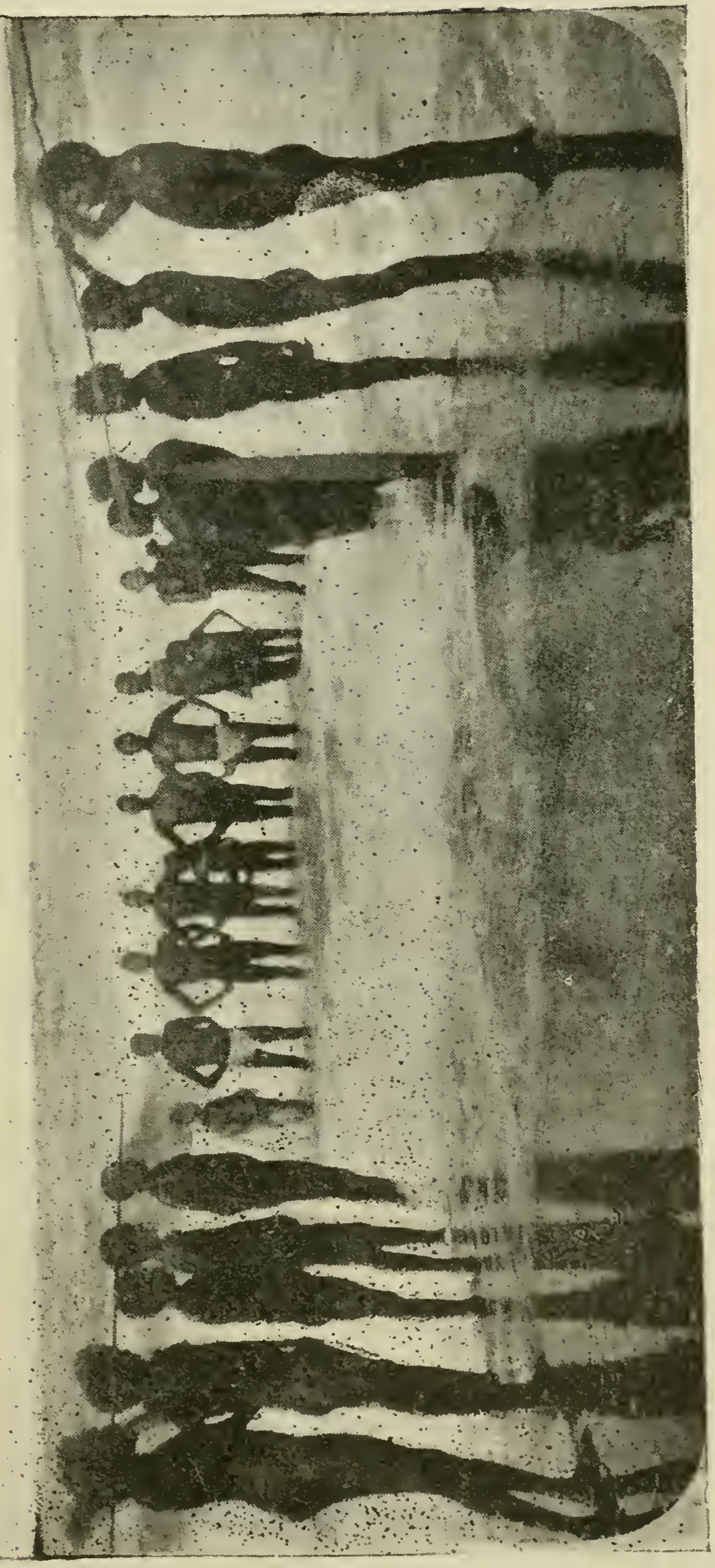
SPEARING FISH.

bags made of strips of lawyer cane, and shaped like a nine-pin with a funnel for a head. The tactics of the fishing party combine to drive the fish towards the silent men having charge of the dilly bags, who manipulate what certainly has the appearance of being a very awkward utensil in the water, with great skill and alertness. Hurried to frenzy by the shouting and splashing of the crowd, and the flurrying of the surface with bushes, the fish dart hither and thither until most of them have found their way into the bags, at the only spots where, for the time being, peace and quietude prevail. At other times a somewhat similar design of basket is used for trapping eels.

Men armed with spears surround and exterminate a shoal detected in shallow water ; and the boomerang and the nulla-nulla as well as the spear form the engines of the solitary fishermen. On one of the islands of the Gulf of Carpentaria the boomerang (I am told) alone is used, the blacks being so expert that little is left to chance. Nearly every fish aimed at is a " dead bird."

Though the woomera, or, as it is known locally, the yellamun, is common in the neighbourhood of Dunk Island, it is not employed as an accessory in the spearing of fish. Further North it is so almost universally, a combination of boomerang and woomera being the most popular form. This dual-purpose weapon is merely a boomerang to one of the ends of which is fitted a spur, which engages the socket in the butt of the spear. While on this subject, it is interesting to note, that though the common form of the implement for increasing the velocity and range of the spear is generally considered to be peculiar to Australia, its principle is embodied in a contrivance which was used for a similar purpose in the New Hebrides in Captain Cook's day. Describing some of the arts of the inhabitants of Tanna, Cook (" Voyages of Captain Cook round the World," Vol. 1., Chapter VI.) says that in the throwing of darts, " They make use of the becket, that is, a piece of stiff plaited cord, about 6 inches long, with an eye in one end and a knot in the other. The eye is fixed on the fore-finger of the right hand, and the other end is hitched round the dart where it is nearly on an equipoise. They hold the dart between the thumb and the remaining finger which serve only to give direction, the velocity being communicated by the becket and fore-finger. The former flies off from the dart, the instant its velocity becomes greater than that of the hand, but it remains on the finger ready to be used again."

It is obvious that the Australian implement is much the more reliable and effective. Cook mentions that with the dart the Tanna Islanders " are sure of hitting a mark within the compass of the crown of a hat at a distance of eight or ten yards ; but at double that distance it is chance, if they hit a mark the size of a man's body,



SHOAL-WATER FISHERMEN.

though they will throw the weapon sixty or seventy yards." Such a standard of markmanship would be regarded with contempt by the average black of North Queensland. The use of this becket (introduced very many years ago by the kanaka) is a fairly common accomplishment among coastal blacks.

In shallow water, too, fish are chased until they become so exhausted and nerve-shaken, that they partially bury themselves in the sand, or endeavour to elude observation by concealing themselves beneath stone or coral, or by remaining passive among sea-weed, trusting, no doubt to protective tints and assimilation with their surroundings. Few of these stratagems of the fish are of avail when once a hungry black is on its track. The science of war, we are bidden to believe, is not designed for the slaughter of mankind, but so to impress the enemy with a demonstration of overwhelming power, force and majesty, that he may become mentally unable or unwilling to offer resistance, because of its obvious futility. So it is with the black in pursuit of a fish or a turtle in shallow water. By noise and bluster he works on the senses of the fish until it becomes semi-paralysed. Then he proceeds callously to the killing, which, in the case of fish, if his right hand is encumbered, he generally accomplishes by a crunching bite into the back-bone at the shoulders.

At rare intervals the black varies his tactics by a night attack which is often highly demoralising. When the moon is on the other side of the world, with spears and flaring torches of paper-bark, he rushes in a band to his raid on the reef to the dismay of startled and bewildered fish. Substitute for the gurgling cadences of semi-submerged coral and mutual muteness and universal dimness, instant noise and splashing, and dazzling lights here and there and everywhere, and it is not to be considered strange that the fish—tipsy with panic and confusion—fail to exercise habitual alertness.

At a certain season of the year—November and December in the neighbourhood of Dunk Island—myriads of fish, about the size of a sardine, appear in shoals, an acre or so in area, or encircle the islands with a living blueish grey frill yards broad. The blacks bestow on this god-send, popularly known as "sprats"—Harengula stereolepis (Ogilby)—the name of Oon-gnahr.

How skilfully does Nature dove-tail her designs! This great multitude of fish appears when it is most needed. The Terns (sea swallows) are rearing their families, and ever need fresh food in unstinted quantities. The small fry come to an excited and enthusiastic market. Slim, silvery king-fish, grey sharks, and blue bonito harry the shoals, ripping through them with steel-like flashes, and as the little fish ruffle the surface of the sea in frantic efforts to escape, the terns take all they want, screaming with satisfaction. Then,

too, the blacks join in the work of destruction. When the frill of fish lies limp on the beach, they fabricate a siene net, cheap but admirably suited to the purpose. Long strands of beach trailers, and grass and slender twigs, are rolled and twisted up—apparently without the slightest art—into a huge loose cable 8 inches in diameter. The men run out the cable into the water at right-angles to the beach, while still the gins with nervous haste are adding to its length. If it breaks a few twists and pokes suffice to repair it. The men at the lead curve in towards the beach, and the gins and pickaninnies, (n.e.i.,) wade out in line to meet them. Gradually the cable, shocking in its frailty, is worked in, enclosing a patch of the fish in a perilous coffer dam. Tumult and commotion are almost as necessary contributories to the success of the stratagem as is the cable, through which the dullest fish might see. But before they realise what has happened, they are in such close company that escape is impossible, and dilly bags are filled in a single dip, and it may take half-an-hour to pick out those "meshed" in the cable. It is all the work of a few minutes, and the haul often amounts in quantity to a surfeit for the whole camp.

One of these rude sienes which I overhauled was composed largely of the long, leafless, twine-like branches of the parasite Cassytha filiformis (which the blacks term "Bun-goonno"), Ipomea pescaprae ("Koree"), Blady-grass ("Jin-dagi,") and the tough sprawling branches of Blainvillea latifolia ("Gallan-jarrah,") the whole being re-inforced with withes of Clerodendron inerne ("Missim,") all of which plants grow on the verge of the sea.

Vast as is the congregation of small fry, it gradually fritters away, martyred to fish, flesh and fowl. By the time the little terns are thrown upon their own resources the violet frill of the sweet islands is frayed and ragged, and drifts loosely in shabby remnants.

For large fish—groper, the giant perch, king, bonito, rhoombah, sweet lips, parrot fish, sea-mullet, and the sting-rays (brown and grey), a harpoon and long line are used. When iron is not available a point is made of one of the black palms, the barb being strapped on with fibre, the binding being made impervious to water by a liberal coating of a pitch-like substance prepared from the resinous gum of the arral tree (Evodia accedens).

The point is eight or ten inches long, the barbless end being swathed in fibre so that it may fit easily into the socket of the eight or ten feet shaft. A long line is tied to the point above the swathing, and being drawn taut along the shaft is secured to the end by a series of clove-hitches. When the fish is struck the point is drawn from the socket, while the shaft acts as a check on, and an indicator of its course when just below the surface. Such harpoons and lines are

also used for the capture of dugong and turtle, the line being made of the inner bark (the bast layer) of one of the fig trees, and is of two strands only. Occasionally the hibiscus tiliaceus is laid under tribute for ropes and lines, which, however are not considered as durable as those from the fig.

Nets, set and hand, are also made with twine from the fig or hibiscus.

When at low water spring tides, the coral reef is uncovered, small rock cod, slim eels, parrot fish, perch, soles, the lovely blue-spotted sting-ray, catfish, flathead, etc., etc., are poked out unceremoniously with spears or sharp-pointed sticks from labyrinthine mazes, or from the concealment afforded by the flabby folds and fringes of the skeleton-less coral (Alcyonaria), or from among the weeds and stones—a kind of additional sense leading the black to the discovery of fish in places that a white man would never dream of investigating. At this opportune time, too, huge, defiantly-armed and brilliantly coloured cray-fish are exposed to capture. A statement was published the other day that this was the speediest of all marine animals. The assertion is much to be questioned, but there can be no doubt that the cray-fish is a wonderful sprinter. Familiar with his lack of staying power, blacks race after it, uproariously, as it flees face to foe, all the graduated blades of its turbine apparatus beating under high pressure. Two or three rushes, and the cray-fish pauses, and then the agile black breaks it long, exquisitely, sensitive and brittle antennae, deprived of which it becomes less capable of taking care of itself ; or it may find its gorgeous armour plates smashed with a stone or penetrated by a spear. For the most part, however, the cray-fish lurks in coral caves, sweeping a considerable frontal radius with ever shifting antennae—not in pride or conceit of their beautiful tints and wonderful mechanism, but with a pitiful apprehension of danger, for the admirers of the creature are many and ever-so-much in earnest—the earnestness of unceasing voracity.

Having a decided partiality for eels, the blacks of North Queensland have devised several means of capture, one of which does not call for the exercise of the least skill on the part of the individual whose longing for the dainty becomes imperative. His placid perseverance too, is of no avail, unless luck favours.

Wading in a shallow, mangrove-bordered creek, he blindly probes the bottom with a six feet length of fencing wire, the modern substitute for the black palm spear. Frequently, he trifles thus with coy fortune for hours, an inch or so separating each prod ; and again, in a spasm of indignant impatience, he stabs determinedly into the mud at random. Non-success does not make ship-wreck

of his faith in the existence of the much-desired food in the black mud, for as far back as his own experience and the camp's traditions go, substantial reason for that faith has been plentifully revealed. He returns to the monotonous occupation until an unlucky eel is impaled, and then it is given no chance of escape.

Pushing his spear a couple of feet through, the boy grips the prize with both hands, or bends the wire into the form of a hook. Fortune may continue to smile, and the boy takes several during the afternoon, and though she may frown and be perverse and say to him nay, it will not be long ere she coaxes him to woo her once again.

Many boys enhance the charms of solitude by ingeniously tricking eels, nature presenting them with an efficient engine of deceit and destruction, so designed that neither the agitations of art nor the invention of science could much improve it. About two feet of the thong or lorum of one of the creeping palms (Calamus obstruens) is all that is necessary. These lora are armed with definitely spaced whorls of re-curved hooks, keen as needles, true as steel, about one-eighth of an inch long. Three or four of the whorls are removed to provide an unfretful, but firm grip. The pot-holes and shallow pools and gullies and trickling creeks, are populated by nervous, yet inquisitive, semi-transparent shrimps, upon which eels liberally diet. So silent and steady of movement is the boy, that even the alert shrimps are unaware of, or become accustomed to his presence, and what is there to warn the eel, enjoying its comfort among the dead leaves in the gloomiest corner of the pool, of danger? Could any but a black boy detect the difference between the brown sodden leaves and the half-inch of body which the eel has unwittingly exposed? The "piggee" (as some term the lorum) is used with meticulous delicacy of touch to hook away two or three of the leaves. Then it is placed parallel to whatever increased length has thus been made visible, and with a decisive twitch the eel is torn from its retreat and killed off-hand.

In creeks and lagoons thin hollow logs are submerged. Eels naturally seek such refuges, and in due course the boy dives, and sealing the ends with his hands brings log and eel to land. Dr. W. E. Roth mentions that cray-fish and a certain fish resembling the rock-cod are similarly captured, and remarks that the log is lifted at an angle, with one hand, closing the lower aperture, in which position it is brought to and held above the surface when the water trickles out between the fingers of the sealing hand.

Yet another method (analogous to "bobbing") is practised for securing eels. Huge worms, found under decaying logs, are threaded by means of a needle formed of a thin strip of lawyer cane

on a line from ten to twelve feet long until several feet of bait are available. The line is merely doubled, the ends made fast to a stout pole and the loop dangled in the water. The boy fishes patiently, nor does he strike at the first nibble, but permits the eel to slowly swallow what might be considered an undue proportion of the bait, when it is landed and compelled to disgorge for the benefit of the next comer.

Among coastal blacks—all of whom may be said to be fishermen—some are ardent devotees to the sea. Others of the same camp restrict themselves to unsensational creeks and lagoons. The frog in the well knows nothing of the salt sea, and its aboriginal prototype contents himself with milder and generally less remunerative kind of sport than that in which his bolder cousins revel. Such a man, however, may possess aquatic lore of which the other is admittedly ignorant, and be apt in devices towards which the attitude of the salt water man is adverse if not contemptuous. The fresh water man is skilful in the use of a net shaped something like the secondary wings of a certain species of moth, and expanding and closing similarly. It is made of fine twine (one inch mesh) preferably from the bark of one of the fig trees or the brown kurrajong, tightly stretched on two pieces of lawyer cane each bent to form the half of an irregular ellipse. This net (" moor-garoo ") is manipulated by two men working in concert, principally for the capture of eels. They do not wait for the eel to come to them, but by shrewd scrutiny discover its whereabouts under the bank of the creek or among the weeds and roots. Then one silent man holds the net widespread, or adroitly dodges it into intercepting positions, while the other beats the luckless fish in its direction with more or less fluster. The persistency with which the creeks are patrolled by men with spears, netted and poisoned, invites one to marvel that any fish escape, and yet once again quite a haul is made.

That great philosopher, Herbert Spencer, once in his life made a joke and confessed to it, with apologies for its littleness. Lunching at a tavern in the Isle of Wight he asked, " Oh! Is not this a very large chop for such a small island? " Similarly I have been astonished at the apparent disproportion between the size of the eel and the insignificance of the creek whence the exulting black has hauled it.

An instance of the poor part which the slimest eel plays when pitted against the smartness and resourcefulness of the black, may be related. A large eel in a moment of indiscretion showed itself in a fairly deep creek. Bewailing the absence of his wing net or " moor-garoo " the boy hunted the elusive fish hither and thither with cunning determination. At last it disappeared under a log.

In most of his activities the black boy sniffs at conventions. Hastily stripping, the boy dived, and when he reappeared the eel was vainly squirming in one of the legs of his trousers, which had been knotted below the knee. Here we see, that the black boy, as a sportsman, is under no restraint to pay tribute to his self-respect.

Another boy, a stranger, brought with him traditions which he successfully materialised in favour of the employment of several light darts instead of a single heavy spear for fishing. The subject was frequently debated, but none of the camp adopted "George's" theories. His favourite weapons were the dried stems of an all too common weed, which generally grows straight and true. Into the thick end he would insert a four inch length of No. 10 fencing wire, sharpened to a delicate point, and with a battery of eight or ten of these he would sally forth. His bag averaged high. Often he treated me to practical demonstrations of the success of his methods. A big flat-head reposed in two feet of water, half buried in the sand. George had one of his darts fast in a twinkling, and the fish flashed away, the tip indicating its movement. In a few minutes the hapless flat-head was carrying no less than six darts, and as such a handicap was absurd, it abandoned the race for life.

On another occasion he struck a big sting-ray so full of his impish darts that it resembled an animated pin cushion of monstrous proportions. It, too, realised the futility of kicking against so many pricks. On the other hand, "Tom" with his heavy shaft and barbed point relies on a single weapon. It seldom fails, for his right arm is strong and disciplined to nicety.

On a shallow tidal creek, a settler had made a corduroy crossing of the fibrous trunks of pandanus palms, which the blacks of the neighbourhood turned to account, in the capture of fish. A few frail sticks, artlessly interwoven with grass, formed a primitive weir at the down stream end of the crossing. Fish which went up with the tide frequently found themselves stranded on the way down, for the water passed freely between the palm tree trunks without affording them right-of-way, and the rude weir often stopped for ever belated bream, mullet, and barrimundi. This simple trap, though it does not appear to be put into use on the coast generally, seems almost to indicate an instinctive knowledge of a studied design described to me by an observant friend who has travelled into many an odd nook and corner of Queensland. On a deep, but narrow tributary of the Georgina River a permanent trap on a large scale was wont to be maintained. A tree had been felled across the stream so that each end of the trunk was supported by the respective bank. Straight stakes were driven firmly into the bed of the creek as closely together as possible, the heads resting against the horizontal tree

trunk. This palisading formed the base of an embankment of packed grass and rubbish, sufficiently tight to raise the level of the stream about three feet. In the middle of the embankment and about 1 foot below water level a hole about 1 foot square had been cut. A platform about ten feet long by three feet wide, having a fall of about one foot and formed of a number of straight saplings laid parallel with the stream, and supported by a couple of transverse bearers on four stout forked sticks, received the escape from the sluice. At the lower end of the platform was a rough weir of twisted grass, which was continued up each side for about half its length. Water passed with little hindrance through the platform, while jew-fish, yellow-tail and bream were retained in considerable numbers.

Many years have elapsed—peradventure centuries—since the blacks of Missionary Bay, Hinchinbrook Island, built a weir of blocks and boulders of granite which oysters cemented here and there. On the fullness of spring tides fish frolicked over and among the boulders. Those which delayed their exit found themselves in an enclosed pool which at certain seasons of the year runs dry. To this day the sea continues to pay tribute! though the blacks of the locality have passed away, and there is none but the red-backed sea eagle or the heavy flighted osprey and a rare and casual white man to receive it. Among the few emblems of the vanishing race this persistent weir taking toll of the fish month after month, year after year, for the benefit of successive generations of eagles and ospreys, appeals vividly to the imagination.

NARCOTICS AND POISONS.

Is it generally known that the most commonly used of the fish poisons on the coast of North Queensland is likewise employed by the natives of Zambesi Land for a similar purpose? The fact remains. The plant is known botanically as "Derris." Two varieties, "Scandens" and "Uliginosa" ("climbing," and "growing in swamps" respectively), are known in this State. The aboriginal titles vary in different localities, but "Bag-garra" will suit the present purpose. Some blacks are so offensively civilised that they know the plant by the name of "Wild Dynamite." Possibly it owes its popularity among fish poisons to the fact that it is the handiest of all. It trails over the rocks, just out of touch of high water mark, but not beyond the reach of the spray of surges. With roots investigating inclement crevices, and salt air damping its leaves, the plant, flourishes and flowers prettily in quite graceful racemes. In the cracks the flowers put on a tinge of pink, literally blushing unseen. The heartless blacks tear up the plant branches, leaves, flowers and all, coarsely bundle them together, and wading into

RAROO.

KOIE-YAN.

an enclosed pool where fish are observed, beat the mass (after dipping it into the water, and while held in the left hand) with a nulla-nulla. The action is repeated until the bark and leaves are macerated, and then the bundle is thrown into the pool. In a few minutes the fish rise to the surface, gasping and making extraordinary efforts to get out of the infected water. Death ensues rapidly, but the fish are quite wholesome as food.

Another of the vegetable poisons is known as "Raroo" (Careya Australis). The bark at the base of the trunk and roots contains an effective narcotic, which is released in a somewhat similar fashion to that employed with "Bag-garra."

A different and, for a black, singularly complicated process is needed for the extraction of the noxious principle residing in the plant known as "Koie-yan" (Faradaya splendida). This is one of the most rampant and ambitious of the many vines of the jungle.

It combines exceeding vigour with rare gracefulness. The leaves are a light glossy green, ovate, and often a foot long, while the flowers are purely white (resembling, slightly, the azalea, but free from its fragility), large, and with an elusive scent, sweet yet incomprehensible. The fruit, smooth and of porcelain whiteness, varies in size and shape. A large marble and an undersized hen's egg may dangle together, or in company with others, from the top-most branches of some tall tree, which has acted as host to the clinging vine. The handsome, but inconsiderate plant, is turned from its purpose of lending fictitious and fugitive charms to quite commonplace but passive trees to the office of stupefying uncomplaining fish. But the element which holds such deadly enmity to the sense of the fish is not obtainable by the simple primary means successful with other plants. Indeed, the process is quite elaborate, and goes to prove that the Australian aboriginal has to his credit as a chemist the results of successful original research, and that he is also a herbalist from whom it is no condescension to learn. In this detail, at any rate, he is a distinctly accomplished person. Portions of the vine are cut into foot lengths; the outer layer of bark is removed and rejected, the middle layer alone being preserved. This is carefully scraped off and piled up in shapely little heaps on fresh green leaves. One might imagine that a black boy preparing the deadly "Koie-yan," was really playing chemist's shop with neat handed scrupulousness. When a sufficiency is obtained it is rubbed on to stones, previously heated in the fire. The stones being then thrown into a creek or a little lagoon left by the receding tide, the poison becomes disseminated with fatal effect to all fish and other marine animals.

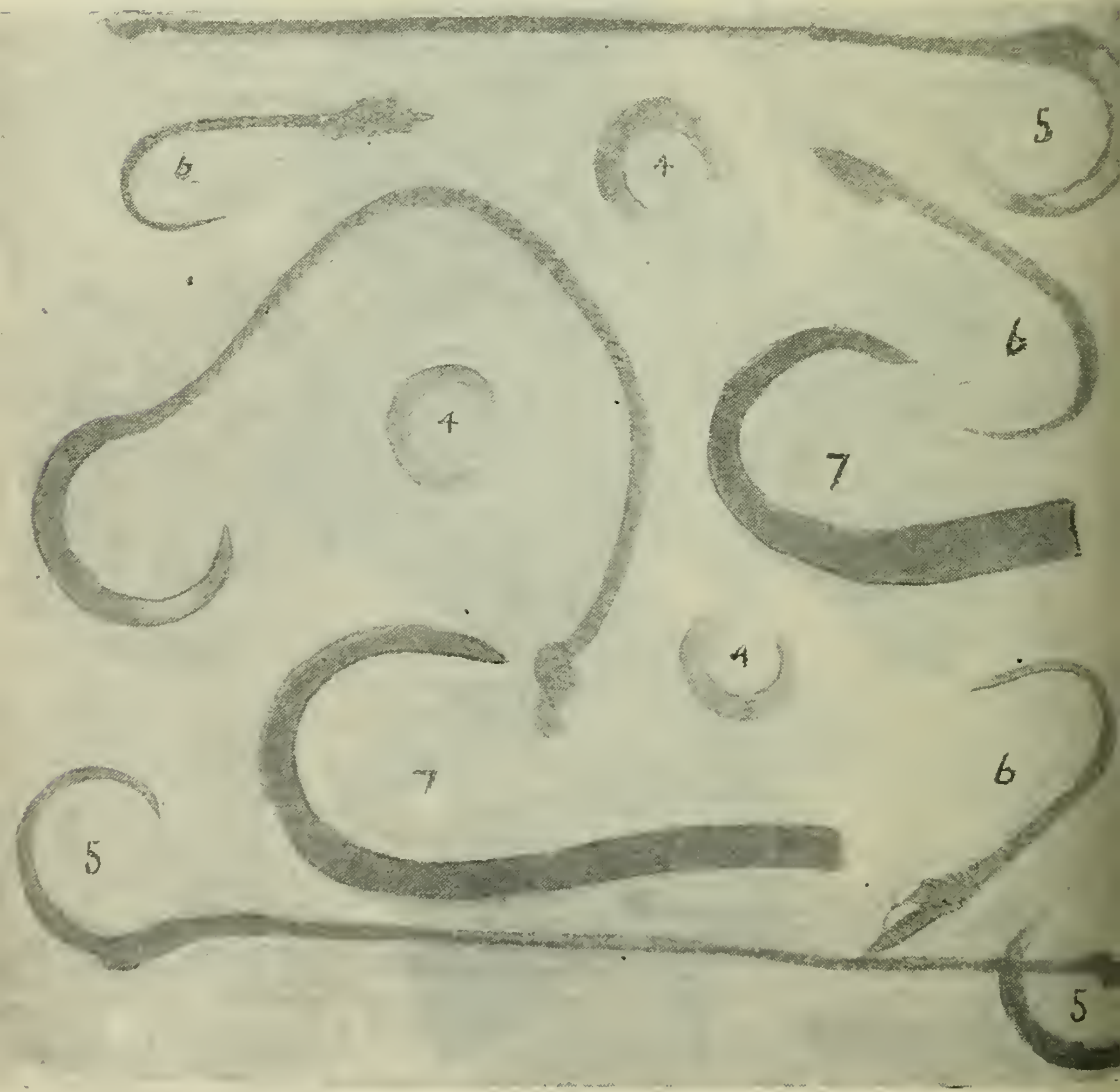
Many other plants supply the means of killing small fish wholesale, or of reducing them to palsied cripples. The three described are fairly common, and have, therefore, been selected to point a moral. Poisoning fish is poor sort of sport perhaps, but there are two classes of fishermen—the hungry and the artistic. The latter use flimsy tackle and complicated gear, and play the game, giving to the victims to their wiles a sporting chance. Though not the only representative

BAG-GARRA.

of the hungry class, the black-boy generally fishes on an empty stomach, and his demeanour coincides. No slobbering sentiment affects him. Yet he is not as cruel as the mean white, who throws a plug of dynamite into the river, the while the fish are enjoying their crowded hour, though he will with as little taint upon his conscience poison a pool full of fish as drag with hooked stick a reluctant crab piecemeal from its burrow among the mangrove roots. But then he is responding to the appeals of a clamant and not over-particular stomach, while your dynamitard is occasionally a well-fed sportsman with a queasy palate.

HOOKS AND LINES.

Little need be said in explanation of the photographs of hooks of pearl and tortoise shell.



No. 4 shows a series of pearl-shell hooks obtained by raking over the sites of old camps on Dunk Island. From what can be ascertained at this late date, these hooks were very sure and killing, but seem to have been used principally for smaller fish—whiting, perch, bream, flathead, etc., the occurrence of large hooks being exceedingly rare. Mullet (if tradition is to be credited) were seldom caught by hook and line, but were speared among the mangroves at high tide—a practice which prevails to this day,

No. 5. Hooks (one of iron and the others of pearl shell) made to order by a patriarch living on the main land opposite Dunk Island. This style of hook has long been superseded. The old man could remember their use only when he was a boy—about half-a-century ago—and was far more familiar with iron than with shell.

No. 6. Tortoise-shell hooks, such as are in vogue at the present day in the uncivilised parts of the Gulf of Carpentaria.

No. 7. Examples of tortoise-shell hooks common among the natives of Darnley Island, Torres Straits. These are capable of holding large king-fish and fair sized sharks. During the process of cutting and paring the hooks to the size and design required, the shell is frequently immersed in boiling water, which temporarily overcomes its inherent toughness. Incidentally it may be pointed out that the evidence derivable from these fish hooks does not afford proof of Papuan influence on the mind of the Australian aboriginal, except at the extreme North of Cape York Peninsula, and a few miles down the eastern coast of the Gulf of Carpentaria. This default seems the more remarkable in face of the fact that out-rigger canoes doubtless of Papuan or Malayan origin, were known as far south as the Johnstone River. The Dunk Island examples have a resemblance to one of the forms of pearl-shell hooks used by the Tahitians in Captain Cook's day.

To say that the coastal blacks of North Queensland had no knowledge of the use of barbed hooks is misleading. In sheer desperation when the supply of pearl-shell hooks was exhausted, they were wont to attach bait to their harpoon points, and they used such unpropitious means successfully, and occasionally made a miniature hook by tying a sharp spur to a thin straight stick. With the knowledge of the efficacy of the barb under extraordinary circumstances is it not the more remarkable that they failed to employ it systematically? Dr. W. E. Roth describes crescentric hooks of coconut shell and wooden hooks with bone barb, and also barbs improvised from one of the spines of the cat-fish. He also mentions as "the most primitive form of hook," the dried tendril of Hugonia Jenkensii ("Pattel-pattel" of the Dunk Island blacks). To any one

familiar with the sickle shape of the pearl shell hooks the use of the singularly apt tendrils of the Hugonia would immediately be suggested; but my observation, inquiries and opinion are entirely contrary. The shape of the tendril is all that can be said in its favour.

With these barbless hooks the bait is never impaled, but strapped on with shreds of bark.

FLY FISHING.

The neatest and most artistic method by which the blacks kill fish necessitates the employment of a particular species of spider

KARAN-JAMARA.

known to the learned as a member of the family Argiophidæ and of the genus Nephila, and may be styled (in the words of Mr. H. Tryon, Government Entomologist, to whom a specimen was submitted), the olivaceous-bodied Nephila.

This spider was discovered on Dunk Island by Macgillivray, the naturalist of the expedition of H.M.S. "Rattlesnake" in 1848.

It has a large ovate abdomen of olive brown, bespangled with gold dust, black thorax, with coral-red mandibles, and long slender legs, glossy black and tricked out at the joints with golden touches. A fine creature, gentle and stately in demeanour, it spins a large web, strong enough to hold the biggest of beetles and other insects, and, to harmonise with the superior air of the manufacturer, the gossamer is of golden yellow. The great spider at the focus of the golden web is a frequent and conspicuous ornament to the edges of the jungle, and having no fear, and no indocility of temper, it undergoes the ordeal of admiration with an assumption of disdainful dandyism. The local name of this spruce and comely creature, is "Karan-jamara."

In pursuance of inquiries—the results of which are herein recorded—a casual black boy, a stranger to these parts and therefore unfamilar with the local name and the special purposes to which the spider is put, was cross-examined. At first he failed to recognise the photograph, but when it was explained by pointed allusion to a living Maltese cross spider close at hand, a gleam of intelligence brightened his bewildered face, and he delivered a self-satisfied dissertation on the order arachnida that is worth quoting :—

"That fella aw-baw-baw. That fella mammy belonga nother fella altogether. You no savee, come close up—that fella ply way. You no savee, come close up, that fella no good, that fella vite."

And the boy looked gravely sagacious and smiled the wide wise smile betokening proud superiority of information. Had Macgillivray but known that the "aw-baw-baw" was the parent of all the many species, and that it belongs to the discreetly valorous class that "vites" and flies away, and lives to "vite" another day, he might have achieved renown of a more popular kind than is the reward of the unromantic naturalist who discovers merely a swell spider.

This spider is used on some of the rivers as a lure, virtues almost irresistible being ascribed to it. Experiments in salt water, though not absolutely negative in their results, have not afforded any specially exciting sport ; but possibly the fascination of the lure is more efficient in fresh than in salt water, and is influential over the habitual caution of a certain species of fish only. The trick is worked in the following manner :—

The angler takes a light, thin switch and entangles one end in the web, which, by dexterous waving action is converted (without being touched with the fingers) into a strand about two feet long. The spider is secured and squashed, and the end of the line moistened in the juices of the body, some of the fragments of which are reserved

for bait, and also to be thrown into the water as a preliminary charm. These buoyant tit-bits attract shoals of small fish, among which the line with its soupcon of spider, is delicately trailed ; a fish rises to the lure, the gossamer becomes entangled in its teeth, and it is landed by a brisk yet easy movement of the wrist. A great angler recently said that throwing a fly is an act of feeling or instinct rather than reason. So the black boy with a careless flourish fills his dilly bag, while he smiles at the serious attempts of the white man to imitate his skill.

Owing to the brevity and the frailness of the line, the catch is limited to fish under the recognised standard as to size. Tests prove that the breaking strain of the line is nearly $\frac{3}{4}$ lb., but the weight of the individual is of no great consequence since numbers are caught quickly. The gossamer is singularly sticky. The viscid substance with which it is coated is not readily dissolvable in water ; indeed water seems to have the effect of hardening it, so that the line wears longer than might be expected. Piquant morsels of the spider are entangled in the frayed end of the line, as its original potency becomes non-effective.

A friend for whose edification this novel method was demonstrated, thus describes it :—

" It did not take the boys long to get ready. They simply broke a switch about 3 feet long and attached a portion of the web about 6 inches long to the end; squeezed out on to a leaf the fluid internals of the spider into which they dipped the end of the line, started a rather melodious chant and put the line in shallow water. I was only a few feet away, and could see no fish at first, but they came very soon. They were very small, about $1\frac{1}{2}$ inch long. They fasten their teeth in the web and are lifted out quite slowly. Some require to be pulled off the line after being landed. I watched for about ten minutes during which time 17 were caught."

Sir William Macgregor has described the Papuan art of fishing by means of kites, the lure being a tassel of the web of a spider of the Nephila species. No doubt the blacks here made an independent and original discovery, and in their simplicity applied it in a different but none the less effective style from that of the advanced Papuan.

Thus to use the web and the fragments of a spider for fly fishing is certainly meting out poetic justice to the spider on account of many ensnared flies ; and the black angler never pauses to reflect whether the comminuted remains of a spider can possibly be construed into a " fair " fly. He has no self-regarding instincts to obey.

SOME ARTICLES USED IN BURIAL AND OTHER RITES BY THE AUSTRALIAN ABORIGINES.

(With Four Illustrations.)

By R. H. MATHEWS, L.S.

Oval-shaped objects used in connection with native burials in the valley of the Darling River, New South Wales, were manufactured from burnt gypsum[1], reduced to a powder, and fine sand or ashes, well compounded with water, just as we would mould anything of the kind out of cement or plaster of Paris. The necessary shape could be given to the mass while plastic, and then allowing it to dry in the sun. These objects are in the shape of a large egg, varying in length from about three to nine inches, by a width, say two and a quarter inches for the smaller ones, up to double that width for the larger. (See block A and descriptive letterpress).

They are often approximately circular in a section through the middle part, but in other cases such a section would be ovate. Some of them are flattish on one or both sides, and are not unlike a cake baked in an elongated form. In a few of the flattened productions, one side is slightly concave, but whether this was intended by the maker it is difficult to say. Probably the wet mass assumed this shape while drying in the sun, because the heat would naturally cause the outer margin, which would dry first, to turn upward, similarly to the way a board warps toward the sun, when exposed in a free state. Nearly all the specimens I have seen were evidently manufactured in the way above described, but an occasional one consists of a piece of sand-stone, or shale, of a light colour, found in the bush, which required but little fashioning to bring it to the required shape.

An old aboriginal of the Ngunnhalgu tribe, known as Harry Perry by the white people, told me that these *kopai* objects, which he called *murndu*, were made out of powdered kopai and a little sand or wood ashes, much in the way we mix up flour when making dough for baking into bread. He said that when a native of either sex died and was buried, the relatives came to the grave and placed these kopai balls on top of the mound of earth. For example, if the body were that of an adult man, his widow would place a *murndu* on the ground above his head. The deceased's brothers would each place

1. Called *kopai* by the natives; often erroneously written *copi* and *kopi* by the European residents of that region.

one or more along one side of the grave ; his mother and sisters might also lay a *murndu* or two on the other side ; and so on.

An old man of the Murawarri tribe informed me that in his language the *kopai* ball or tablet is called *yurda*. When a man, woman, or young person beyond the age of childhood, died, leaves were strewn over the earth covering the grave, and on top of the leaves were laid the *yurda*. There might be only one or two *yurda* deposited, or there might be more, depending upon whether the deceased had few or many friends. Mr. E. J. Suttor writes me that he has seen a dozen or more of the kopai balls lying on a native's grave. They were put on as soon as the corpse was buried.

A Ngeumba blackfellow told me that in his tribe the name of the *kopai* balls is *dhaura*. The gypsum was collected, burnt and pounded fine by the women, and the men shaped the *dhaura*.

A resident informs me that gypsum is very plentiful on Yantara Station, near Lake Cobham, about 120 miles north-westerly from the Darling River, where tons of it could easily be obtained. Another correspondent, at Kallara Station, on the Darling, states that gypsum is quite plentiful there. In fact, gypsum and pipe-clay are both easily obtainable along the valley of the Darling, as well as in the hinterland, all the way from its junction with the Murray river up to Brewarrina. There is also a kind of slacked or rotted gypsum, which occurs in patches, resembling slacked lime.

Old Perry and others above quoted, said that the object of decorating the grave in the way described, was to induce the *bori* or spirit of the dead person, to remain in its place of sepulture, and thus prevent its roaming through the camp at night to do injury to anyone with whom the deceased might in his or her lifetime have had a feud. When the spirit saw that its owner's death had been properly mourned for in accordance with the tribal custom, it felt more friendly towards everybody. The spirit comes up during the night and sits on top of the grave, and commences licking or sucking one or more of the kopai balls.

Sir Thomas L. Mitchell is the first author to mention these *kopai* balls. He says, " It was on the summit of a sandhill where I fixed my depot on the Darling (Fort Bourke) that we saw the numerous white balls, and so many graves. The balls are shaped as in the accompanying woodcut, and were made of lime. . . . A native explained one day to Mr. Larmer (a member of Sir Thomas's staff) in a very simple manner, the meaning of the white balls, by taking a small piece of wood, laying it on the ground, and covering it with earth. Then laying his head on one side and closing his

eyes, he showed that a dead body was laid in that position in the earth, where these balls were placed above[1]."

In 1901 Mr. G. Officer, of Kallara Station, described some kopai balls or cakes found at a grave on Curronyalpa run on the Darling River, about 15 miles above Tilpa. There were 39 specimens at the grave, some of which were lying on the surface, others were

BLOCK A —KOPAI BALLS

partially revealed, and the remainder were found by digging a little way into the sandy soil underneath.

Owing to the unusually large number of pieces on this grave, I am inclined to believe that the greater portion of them had been carried from other graves in the neighbourhood to this spot and hidden for the purpose of protecting them from the vandalism of the white men, who were in the habit of carrying them away as curios. Mr. Higgins, a long resident of the Darling region, writes me, that two old blackfellows had stated to him that when the natives observed that the white people desecrated their burying places in this way, they themselves buried the kopai balls in the ground to keep them out of sight. Possibly nearly all the specimens recovered by Mr. Officer had originally been concealed with earth, but the violent winds of that district had blown the

1. Three Expeditions into Eastern Australia (London, 1838), Vol I., pp. 253-254. Seven *kopai* balls are illustrated in the woodcut referred to.

F

sandy soil away and left them visible. The grave was on a sandhill about three miles back from the river, and was therefore out of the way of the white men, whose principal traffic lay along the course of the stream.

Explanation of Block A

This picture exhibits three medium-sized balls, and one small one, all of which are made from gypsum (kopai), as above described. I shall call them *murndu*, their native name in the Ngunnhalgu tribe, which occupied the country from about Wilcannia up to near Louth, being the tract from various parts of which my specimens were obtained.

Fig. 1. The *murndu* numbered 1 in the picture is $6\frac{3}{4}$ inches in length, by a maximum width of $4\frac{3}{4}$ inches. The thickest part, at right angles to the width, is $3\frac{7}{8}$ inches. The weight of the article is 2lbs. 9 ozs.

Fig. 2 measures $2\frac{3}{4}$ inches in length, by a mean thickness of $2\frac{1}{8}$ inches. Weight, $4\frac{1}{2}$ ozs.

Fig. 3 has a length of a trifle over $7\frac{7}{8}$ inches, and its greatest breadth is $4\frac{1}{8}$ inches. It is oval in section, with a thickness of $3\frac{1}{4}$ inches. Weight, 2lbs. 14ozs.

Fig. 4 is $6\frac{9}{16}$ inches long, with a maximum breadth of $3\frac{15}{16}$ inches. It has a practically circular section through the middle. Weight, 2lbs. 8ozs.

Scattered here and there through the composition of the *murndus* are pieces of gypsum as large as gravel, showing that the mineral was not very well pulverised, a fact which does not surprise us when we remember that the natives had to burn the gypsum in a camp fire. For the same reason the powder became mixed with small quantities of wood ashes.

Mourning Caps.

Helmet-shaped objects called *kurno*, known to have been worn on the heads of widows as a sign of mourning, were made from gypsum, burnt and pounded fine, and mixed with water. A fibre or rush net was first placed on the woman's head to protect the hair, and the soft mixture applied outside until it resembled a cap, hence called "widow's caps" by the Europeans. (See blocks B and C). The mixture was not all put on at the same time, but by a serise of additions extending over a few weeks. The marks of the meshes of the net are distinctly visible in the interior of some of the caps of this kind, which have been preserved by white men. When the mourning cap had been worn the customary time, it was taken off and placed by the widow upon the grave of her late husband. When

the deceased left a plurality of widows, each wore an emblem of mourning, and disposed of it in the same way. If the net was firmly embedded in the dry gypsum, it was left in it, but if the net could be readily detached it was taken out of the cap for future use. In some cases, portions of the women's hair had to be cut to get the cap off. When the net was left in the cap, it rotted away, but its imprint remained. I have seen "widows' caps" weighing from about half a dozen pounds up to twice as much.

A station owner who has resided on the Darling river for more than thirty years informs me that he has occasionally seen blackfellows, as well as black women, wearing mourning caps of this description.

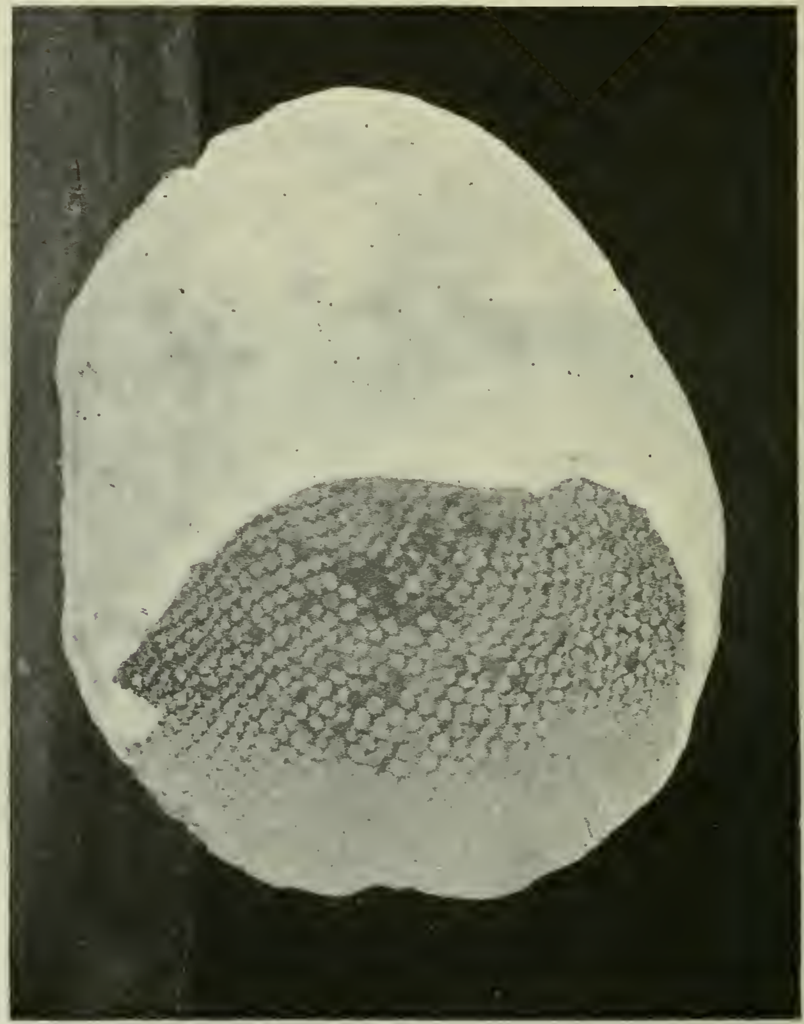
Sir Thomas L. Mitchell reports that on the Darling River he found "casts in lime or gypsum, which had evidently been taken from a head, the hair of which had been confined by a net, as the

BLOCK B.—MOURNING CAP, OUTSIDE VIEW.

impression of it, and some hairs remained inside." The same author states that, on the Murray, some distance above its confluence with the Darling, he saw some native graves with mounds of earth raised over them, on which were laid the "singular casts of the head in white plaster," which he had before seen at Fort Bourke. In some cases the casts of the head were found lying beside the gypsum balls. He

gave illustrations of two of these casts, showing also the marks of the net inside[1].

In 1838 Mr. Joseph Hawdon observed some skull-shaped caps, made of white plaster, which he thought was obtained by burning shells and grinding them into powder. They were laid on the grave of a native near Lake Bonnie on the Murray River. He says that inside the cap was a network of twine. Mr. Hawdon states that he also noticed a great quantity of crystallised lime or gypsum in the locality; it was in masses some tons weight[2].



BLOCK C.—MOURNING CAP, INSIDE VIEW.

Mr. E. J. Eyre gives an example of the "Korno, or widow's mourning cap, made of carbonate of lime, moulded to the head." The specimen illustrated by him weighed 8½ lbs.[3]

1. *Op. cit.*, Vol. I., pp. 253-254, and Vol. II., p. 113.

2. Diary of an Overland Journey from Port Phillip to Adelaide in 1838. (MSS).

3. Journs., Expeds., Discov. Cent. Australia (London, 1845), Vol. II., p. 509, Plate I., fig. 17.

Block B is an exterior view of a *kurno* or widow's cap; 1 being the front or part fitting over the forehead, whilst 2 represents the back of the head.

Block C shows the interior of the cap, with the marks or impression of the net and the size of its meshes plainly discernible. This cap weighs 7lbs. 1oz., and has been formed of *kopai* or gypsum in the way already described. The specimen was found on a native grave on the Lower Budda run, Darling river. For the two photographs, taken at my request, I am indebted to Mr. F. W. Beattie.

Ceremonial Stones.

The following is a short description of some remarkable stones which were used in the secret ceremonies and incantations of the aborigines in the northern portion of New South Wales. This region may be approximately defined as lying north of latitude 34 degrees, and west of longtitude 148 deg. The objects referred to have been observed by squatters and other residents of the bush in different places for many years past, but like most other matters connected with the aborigines, very little attention has been paid to them. They are now found lying on the surface of the ground, or only partially exposed, on the flanks of sandridges which have been old camps of the natives or perhaps places of ceremonial gatherings. They had probably been hidden away when not in use, or at the death of the owner, and had since been exposed by the removal of the loose sandy soil during the violent gales which sweep over that district in dry seasons. Specimens have also been found below the surface when digging for other purposes.

These stones vary in length from about half a foot to two feet, and the more common lengths are from 9 to 15 inches. They are widest at the base and taper upwards to the other end, which terminates in a blunt point. Some of them have a large number of marks cut into the surface with a sharp stone, shell, or piece of bone; some have but a few such incisions, whilst others are quite plain. A characteristic of this type of native implement consists in the presence of a depression worked into the base in the following manner. In nearly all the specimens, instead of the proximal or large end of the stone being flat, the central part has been picked out with a sharp-pointed stone, and afterwards ground fairly smooth. These hollows are deepest at the centre, gradually decreasing outwards all round to the margin, forming a concavity resembling a shallow saucer or trough, the shape of the concavity depending upon whether the base is round, or is longer in one direction than in the other.

In the majority of specimens which have been recovered, the longitudinal axis is practically straight[1], and a transverse section through any part of the shaft would have an almost circular outline. There are other specimens, however, in which a section at right angles to the length would have the form of a considerably elongated oval; in some cases the longer diameter of such section is more than three times the length of the shorter one. In the present monograph I have prepared an original plate illustrating four specimens of the oval or flat variety of stone, because they are more uncommon than the round or cylindrical ones. Examples of the latter will be described by me in another paper.

The diagrammatic drawings in the accompanying plate represent the exterior or bounding lines of each stone with strict accurracy. For example, No. 1 is a front view, and No. 2 is the edge of the same stone. The outline only of the stone is given in each case, without any shading, because it is thought that this will give the reader a sufficiently clear idea of what the article is like. I have not thought it necessary to supply drawings of the bases of the stones, showing the concavity, but in Nos. 1, 5, and 7, I have stated the depth of the hollow in each case. I have selected specimens consisting of different kinds of stone ; for example, soft sandstone, hard sandstone, clay slate, and quartzite, for the purpose of showing that the natives made use of whatever material was available. I have included a stone, No. 5, which is profusely inscribed, and another, No. 3, which is without the usual hollow in the base, the latter being rather uncommon.

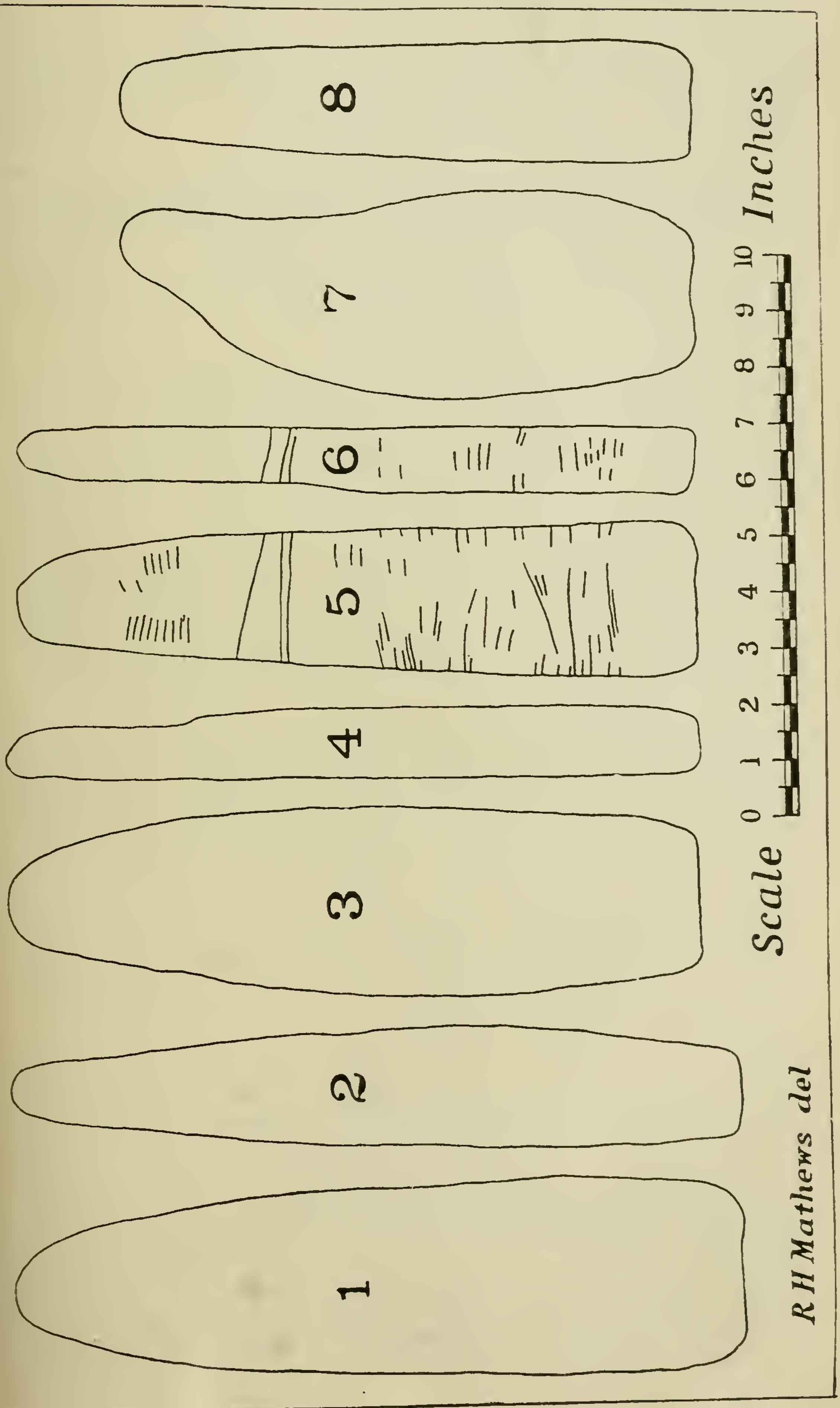
Explanation of Block D

No. 1 is a fine-grained sandstone, $12\frac{15}{16}$ inches in length, and a maximum width of $3\frac{1}{2}$ inches. No. 2 is a profile view of the stone, standing edgeways in front of the spectator, the thickness of which is $2\frac{1}{8}$ inches, or less than two-thirds of the width. The base, or large end, has the characteristic concavity or trough ground into it to a depth of $\frac{1}{20}$ of an inch. Three well defined incisions appear on the opposite or invisible surface of the stone, but on the face shown in No. 1 there are only a few obscure scratches which I have not re-produced. The specimen, which was found on the eastern side of the Warrego river, weighs 3lbs. 8ozs.

No. 3, a coarse-grained, hard sandstone, is $12\frac{1}{8}$ inches long, and $3\frac{3}{10}$ inches wide.

No. 4 shows the profile, the transverse measurement of which is $1\frac{1}{4}$ inch, being only a little more than a third of the breadth. The

1. Some specimens, instead of being straight, are bent over to one side, giving the shaft a very pronounced crescentiform outline.



Block D.—Ceremonial Stones.

base of the stone has been ground smooth, but there is no concavity. There are no marks cut into any part of the surface of this specimen, which weighs 3lbs. 0 ozs. It was picked up on Tankarooka run, Darling river.

No. 5 consists of dark-coloured clay slate, a trifle under a foot in length; and the greatest breadth, which is near the base, being $2\frac{4}{5}$ inches.

No. 6 is a side view showing a thickness of $1\frac{4}{5}$ inch or slightly more than half the breadth. The stone was found on Tankarooka run and weighs 2lbs. 6ozs.

The face of the stone shown in the illustration is slightly convex, whilst the reverse is practically flat, but rounded off towards the edges. Both faces contain a large number of marks cut into the surface with some sharp instrument, such as a mussel shell, a sharp flake of stone, or a marsupial's tooth. Some of the best defined of these marks are cut to a depth of about a sixteenth of an inch.

No. 5 exhibits 72 of these incisions, and No. 6 shows 22, in addition to an irregular spiral cut which extends round and round the implement in three folds or laps. The terminal ends of the spiral incision are on the reverse face, and consequently do not appear in the drawings. There are also a large number of incisions on the reverse face, similar to those illustrated.

The base or larger end of the stone is in the form of an elongated oval, and has three of the usual trough-like concavities chipped and ground into it in the direction of its longer diameter. The larger of these depressions is $\frac{3}{40}$ths of an inch deep, but the other two are very shallow, although easily discernible. The present is the only case in which I have seen three of these concavities in one stone—a single depression being the general rule.

No. 7. This peculiarly-shaped specimen consists of a hard pebble of quartzite— having a length of $10\frac{1}{8}$ inches, by a breadth at the widest part of $3\frac{5}{8}$ inches.

No. 8 is a profile view, the greatest thickness of which is $2\frac{2}{5}$ inches. The face given in No. 7 is almost flat, and so is the reverse face, both being in their natural state as originally found by the native workman. The sides were then chipped in places to bring the implement into its present pointed form. A transverse section through the middle of the stone would give an irregular four-sided figure, with the four corners rounded off—a shape not often observed.

The specimen was discovered on Tankarooka run, and weighs 4lbs. 7ozs. A saucer shaped concavity is chipped into the base to a depth of $\frac{3}{40}$ths of an inch.

PROCEEDINGS

OF THE

Royal Geographical Society of Australasia,

QUEENSLAND.

ANNUAL GENERAL MEETING,

JULY 30TH, 1909.

His Excellency the Hon. Sir Arthur Morgan, Kt., F.R.G.S., occupied the chair.

There was a large attendance.

The minutes of the previous monthly meeting were taken as read and duly confirmed.

The Hon. Secretary and Treasurer (Dr. J P. Thomson) read the annual report of the Council, and submitted the financial statement; both of which were adopted on the motion of Messrs. Geo. Phillips, C.E., and E. E. Edwards, B A.

The following officers and Council were then elected:—

President:

His Excellency Sir William McGregor, G.C.M.G., C.B., M.D., LL.D., D.Sc, Hon. F.R.S G.S. (Edin.), Etc.

Vice-President:

Geo. Phillips, Esq., C E.

Hon. Secretary and Treasurer:

Dr. J. P. Thomson, LL.D., Hon. F.R.S G.S. (Edin.)

Other Members of Council:

His Excellency the Hon. Sir Arthur Morgan, Kt., F.R.G.S., Lieut.-Col. James Irving, M.R.C.V.S.L., etc., Hon. F. T. Brentnall, M.L.C., George Fox, Esq., M.L.A., Jas. Stodart, Esq., M L.A., E. C. Barton, Esq., M.L.A., Allan A. Spowers, Esq., J.P., E. J. T. Barton, Esq., Alexander Corrie, Esq., J.P., Alexander C. Raff, Esq., C.E., E. E. Edwards, Esq., B.A.

REPORT OF COUNCIL.

24TH SESSION, 1908-1909.

The Council has pleasure in submitting to the Fellows and Members the Twenty-fourth Annual Report on the operations of the Society during the financial year ending on the 30th June, 1909. While alluding with gratification to the satisfactory financial position of the Society, the Council deeply regrets the loss sustained by the death of two greatly valued subscribing Members who for many years were largely identified with the industrial and public life of the State. In the late Hon. John Leahy the Society has lost a warm supporter, a greatly valued officer, and the country one of its most esteemed citizens. Concurrent with the untimely demise of this distinguished statesman came the sudden and unexpected death of Mr. William Collins, no less renowned as a worthy representative of one of the earliest pioneer families, who did so much to open up and settle the Upper Logan district and other parts of the State. The death is also announced in his 90th year of Mr. G. F. Sandrock, of Rockhampton, who joined the Society a couple of years ago. In thus alluding to the heavy loss sustained by the passing away of these greatly valued supporters, the Council is gratified to find that the membership roll has been increased by the addition of a number of new subscribing Members, including a lady. It is, however, felt that the usefulness of the Society would be greatly increased and extended by a larger annual accession of Members, and the Council hopes that during the ensuing anniversary year an effort will be made to bring in a large number of supporters to help in the good work so actively prosecuted during the past. As intimated in the preceding report, the demand for the "Journal" continues to increase year after year, with a corresponding outlay for postage and printing. It would, however, be in the interests of the Society, and of the State, at large, were the income sufficient to justify an enlargement of the "Journal," and its even wider circulation in the various countries to which it is now sent.

The activity of the Society has again been well sustained during the preceding year, the meetings having been largely attended, while the subjects discussed cover a wide range, and are of much interest and importance. At the opening meeting of the session, an interesting address was delivered to an exceptionally large and appreciative audience by the Honourable J. W. Blair, who gave a popular description of his long and successful journey through Queensland by motor car,

the narrative being fully illustrated by a great number of lantern slides. This was followed at the next monthly meeting by an instructive lecture from Mr. W. H. Dudley Le Souef, who dealt at great length with the subject of "Australian Natural History," the address being profusely illustrated by lantern slide pictures. At the succeeding meetings the following papers were read and discussed:— (1) "With the Navigators on the Commonwealth Coast," by Mr. L. C. Horton (read by Mr. A. A. Spowers, Surveyor-General, in the absence of the author), with lantern slide illustrations. (2) "An Account of the Proceedings of the Geneva International Geographical Congress," by Mr. E. C. Barton, M.L.A., the Society's Delegate, with numerous lantern slide pictures. (3) "The British Solomon Islands," by Mr. Claude L. Bernays (read by Mr. L. G. Corrie, in the absence of the author), with lantern slide pictures. (4) "Blacks as Fishermen—Expedients, Devices, Stratagems," by Mr. E. J. Banfield (read by Mr. Alex. Corrie, in the absence of the author), with lantern slide pictures.

As indicating the varied interests represented by the subjects brought before the Society from time to time, allusion may be made to some of the more important local public measures recently enacted and promulgated by the State Government, and originally advocated through the medium of some of the papers read at the monthly meetings. In the matter of urban parks and recreation grounds, it has always been recognised that rural beauty spots and places affording climatic and physical advantages should be reserved for public use, and no later than last session this view was urged in the case of the Lamington Plateau, named and explored by a former President of the Geographical Society. But although no active steps have as yet been taken to utilise this border area for health or other special purposes, it is satisfactory to note that two places on the Main Range to the west have been proclaimed and set apart as national parks, both being associated with the name of Allan Cunningham, the discoverer of the Darling Downs. The first to be proclaimed was an area, including Mt. Dumaresq, from which Cunningham, in 1827, obtained a panoramic view of the surrounding country, and the other reservation takes in Cunningham's Gap, situated a little farther to the east.

The financial position of the Society is satisfactory, and shows that, with due care, much useful work may be accomplished, even when the source of income is comparatively limited. It would, however, be in the best interests of the State, as well as of the Society were the yearly subscriptions supplemented by an annual grant or endowment from the public funds, as in the case of other cognate bodies located elsewhere. In addition to the standing Medal Fund of £250 vested in Royal Bank preference shares, and £7 4s. 8d. to the credit of the Fund in the Government Savings Bank, the last

financial year closes with a current credit balance of £71 5s. 10d., the details of which are set out in the accompanying balance-sheet.

The accessions to the Library from exchanges and other sources continue to increase yearly to such an extent as to tax the resources at the disposal of the Council for accommodating the many valuable literary works that come to hand from time to time, and which at the present are not easily accessible on account of the congested state of the shelves.

In summarising the work of the last session, brief reference may not inappropriately be made to the Ninth International Geographical Congress, held in Geneva about the middle of last year. and attended by Mr. E. C. Barton, M.L.A., who efficiently acted as the Society's Delegate. and, as hereinbefore stated, subsequently gave an interesting account of the proceedings thereof at a monthly meeting of Members. Associated with Mr. Barton in his representative capacity was the Honourable William Kidston, State Premier, who, on his trip to Great Britain, was accredited by the Council to represent the Society while absent from Queensland.

In the field of exploration and discovery the period now under review has been remarkable for great achievements and notable occurrences. In South-West Arabia Mr. G. W. Bury has undertaken an extensive expedition with the object of penetrating into the unknown interior of that interesting country, where he intends to examine some of the buried cities and to procure copies of the inscriptions at Mareb. Should he succeed in striking the supposed Oman-Mecca pilgrim route. he will make for Muscat.

The results of Dr. Sven Hedin's last long journey have recently been laid before the parent Geographical Society in London, showing that one of the remaining great blanks on the map of Tibet has at last been filled up, after years of strenuous labour in the field of exploration and discovery. Dr. Hedin began his recent series of explorations in August, 1906, when he entered Tibet via Chinese Turkestan, crossed the great mountain range to Shigatse, thence found his way to Lä-däk, exploring en route the sources of the Brahmaputra, Sutlej, and Indus. As indicating the extent of his explorations, mention may be made of his new map of Tibet covering 900 sheets. All the heights, the passes, the river crossings, and the encampments are recorded: a hundred astronomical points have been fixed; several thousand panoramas have been taken, with compass bearings and names. Dr. Sven Hedin has brought back photographs, pencil drawings, and water colours. Meteriological observations were made three times daily, and the explorer has geological specimens with the dip and fall of the rocks from 1,200 different points. The total length of his journeys was 4,000 miles. In Dr. Hedin's opinion, the most important point brought out by his expedition is the dis-

covery of the continuous mountain chain which, taken as a whole, is the most massive range on the crust of the earth, its average height above sea-level being greater than that of the Himalayas. Its peaks are 4,000 to 5,000 feet lower than Everest, but its passes average 3,000 feet higher than the Himalayan passes. The Eastern and Western parts were known before, but the central and highest part is in Bongba, which was previously unexplored. Not a tree or a bush covers it; there are no deep-cut valleys as in the Himalayas, for rain is scanty. The absolute heights remain to be calculated from observations made on the ten passes crossed. The range Dr. Hedin proposes to call the Trans-Himalaya Range.

Dr. A. M. Stein, whose main object has been the search for the treasures that have been buried for centuries under the ever-encroaching sands of Central Asia, has returned to England, bringing with him the results of the accurate surveys of some thousands of square miles of unmapped plateau and mountain country, carried out by his carefully trained native Indian surveyor, Rai Lal Singh and assistants.

Recent information has been received from Captain d'Ollone, the leader of the expedition at work on the Chino-Tibetan frontier. He has proved the existence of a small conclave of Mongols living in the midst of the Tibetans. In its physical character this region is said to differ entirely from the more typical parts of Tibet. It is inhabited by a pastoral people who live on horseback. Captain d'Ollone says that they approach the Aryan type.

An adventurous English traveller is now on his way through Assam with the object of solving the problem of the unknown stretch of the Lower Brahmaputra which flows for a hundred miles or more through the country of the intractable Abors. The unfortunate Mr. Brooks, who was recently murdered on the Tibeto-Chinese border, was bent on solving the same problem from a different direction, and had, as a matter of fact, mapped much of the little known country through which he had to pass.

In the Himalayas, Dr. and Mrs. Bullock Workman have spent some considerable time in exploring and making detailed surveys of the Hunza, Naggar, and Hispar Glaciers and their branches. Much of topographical and glaciological interest was discovered in the exploration of the Northern branches of the Hispar Glacier, which are from twelve to fifteen miles long. A base camp was established at 16,000 feet, on the last mountain flank below the ice-falls leading to the Hispar pass, and from here the various ascents were carried out. The most important, and because of its extended view, of much topographical and geographical importance, was that of a sharp triangular snow pyramid crowning the watershed between the Hispar and Biafo Glaciers. From a snow camp, at over 19,000 feet, Mrs. Bullock

Workman, guide, and two porters, climbed over a dangerous preciptious icy aréte of 2,000 feet to the summit, which is between 21,000 and 22,000 feet; while Dr. H. Workman at the same time ascended a somewhat lower mountain for photographic and observation purposes. The view before referred to from the higher peak included the full sweeps of the thirty-miles-long Hispar and Biafo Glaciers and the great peaks to the source of the Baltora more than sixty miles distant to the East.

On completing the Hispar survey, the expedition crossed the 18,000 feet Hispar Pass, and after investigating a large unknown glacier running South-East from Snow Goke, at the head of the Biafo, descended the Biafo Glacier to Baltistan. Mrs. Bullock Workman is the only woman who has traversed the Hispar and Biafo Glaciers.

Dr. Merzbacher, the Austrian geologist and explorer, is conducting his second expedition into the Tian Shan Mountain, while news ought soon to be heard of the doings of the great Russian expedition under Kozloff in the wide field that lies to the North of Tibet.

In New Guinea very little exploratory work has been accomplished during the period under review. Recently the Dutch have attempted to penetrate the great unknown area belonging to them, the attempts having been made from the South; but they have not yet succeeded in getting any distance from the coast towards the great Charles Louis Range, whose snow-mantled summits have several times been seen from the coast.

It is reported that Mr. Einar Mikkelsen, who recently attempted to reach the Great Arctic Continent, in the existence of which he believes, will shortly leave for Dutch New Guinea. We are, however, perhaps, more interested in the British Expedition, originating in the Natural History Museum, London. It will enter somewhere on the South Coast, and make its way to the Charles Louis Range. The hope has been expressed that a party will make its way right across the island to the North Coast, and thereby solve one of the outstanding problems of geographical science. The neighbouring Bougainville Island has recently been very thoroughly explored by a German expedition; while a British expedition, mainly anthropological, is at work in another of the Solomon Group.

In Africa there is a wide field for exploration, and many exploring parties are scattered over that vast country. Mr. Hanns. Vischer has recently given an interesting account of his journey across the Eastern Sahara. Mr. Vischer had hoped to reach the Tibesti highlands, the practically unexplored mountain range which runs for some 700 miles north-west from Dur Fur into the heart of the Sahara. This is one of the few big things remaining to be done in Africa, and Mr. Vischer will endeavour in the future to accomplish the object which he failed to carry out in his recent expedition. The expedition under Lieut.

Boyd Alexander, which recently left England, will be engaged in the study and collection of the birds and other animals in the Kamerun Mountains and the Island of Sao Thomé. Mr. Chevallier, another distinguished African explorer, has set out for Senegal on an expedition of some magnitude, intended to extend from the coast to the Niger, and from Ashanti to the Southern Sahara. Some of the recent journeys in Africa are, however, hardly to be described as exploring expeditions, being merely in the nature of pleasure excursions in search of big game, or for the love of adventure. Such is, no doubt, the purpose of Miss Charlotte Mansfield's journey from the Cape to Cairo along the route taken by Miss Mary Hall some time previously. The most recent hunting expedition, is however, associated with the name of Ex-President Roosevelt, who is travelling in the Great Rift Valley in search of big game and adventure.

In South America there is probably more unexplored country than in any other part of the inhabited world. Peru and Bolivia have during recent years, attracted the attention of men from the United States, and several exploring expeditions have been doing a great deal of pioneering work there. Great Britain has, however, also been represented by Major P. H. Fawcett, who has done some good work on the borderlands of Bolivia in connection with the demarcation of the frontier between that country and Brazil and neighbouring States. Here the mineral areas are reputed to be rich and extensive, and the unexplored tracts offer tempting inducements to the enterprising pioneer in search of profitable occupation and adventure. In the neighbouring Argentine Republic there are also extensive virgin fields to be opened up and examined, and here, too, British interests are not wholly neglected in the industrial and pioneering life of the country. But all these great human enterprises, all the exploratory achievements of which we have spoken, are as nothing compared with the gigantic works undertaken by the United States Government, and now far advanced, in the construction of a canal across the Isthmus of Panama, which may possibly cost in the aggregate as much as 500 million dollars, or about twice as much as nine of the greatest existing ship canals. Already the amount authorised to be appropriated by the Act of June, 1902, comes to 185 million dollars. In the mysterious polar regions some remarkable work has been accomplished, especially in the Antarctic area, where our knowledge has been greatly extended by Lieut. Shackleton's brilliant achievement as leader of the "Nimrod" Expedition, which penetrated across the great barrier ice to within 97 nautical miles of the South Pole, or 366 miles farther than any preceding expedition. As Dr. H. R. Mill has stated in the May number of "The Geographical Journal," "Captain Scott was the virtual pioneer of land exploration in the far south, and he proved in his great southern journey the practicability of the barrier surface for sledging, and in his

western journey the existence of the vast plateau beyond the bordering mountains, and the possibility of reaching it, and of travelling over its surface." And while Shackleton was dashing away towards the end of the earth's axis over immense glaciers, up the steep slopes of rugged mountain masses and over the surface of an extensive plateau more than 10,000 feet above sea level, his colleague, Professor David, of Sydney University, made a journey of no less interest to the north-west, ascending to the plateau and reaching the south magnetic pole. The failure to reach this point was felt very keenly by Sir James Clarke Ross in 1842. In the peaceful pursuit of science, other nations are joining hands with the British within the polar regions of both hemispheres. Dr. Charcot, in the ship "Pourqa pa," is now operating on the Graham Land side of the Antarctic, where French interests are well represented by a traveller of wide experience and determination. And it is understood that other expeditions are in contemplation. The North Polar area still retains a peculiar fascination for the modern explorer whose energies have for so long been devoted to the arduous task of unfolding many of the hidden secrets of that most inhospitable country. At present, Commander Peary is continuing the explorations which he has for so long conducted in the face of untold hardships and innumerable difficulties.

Norwegian and Swedish interests have for long been represented in the struggles to reach the North Pole, and next year Capt. Amundsen intends leaving Norway in the "Fram," making his way to Bering Strait, where he will push through and enter the current in which Nansen drifted, only much further to the east. He hopes in this way to drift north and north-west across the North Polar basin, probably attaining a higher latitude than was reached by his predecessor, Capt. Sverdrup, in the "Fram" after Nansen and Johanssen left the ship approximately in lat. 86 degrees north. Capt. Amundsen will look out for indications of land, though the general opinion is that the whole of the Polar basin is filled by a deep ocean, and that very probably no land will be found anywhere beyond the groups of islands off the North shores of the Continents. He hopes to ultimately emerge on the east coast of Greenland, after his long drift across the North Polar basin. Mr A. H. Harrison is also projecting an expedition right across the North Polar Ocean in the belief that a great Arctic land mass exists somewhere to the north of Bering Strait. His idea is to travel by means of dog and Eskimo sledges across the Polar basin, believing that during the winter the sea would be completely frozen over and could be traversed by sledges without any insuperable difficulty. Arctic authorities are, however, doubtful of the practicability of such an enterprise, contending that in the absence of moonlight during the Arctic night the Eskimo would not be likely to travel in the winter darkness.

Capt. G. I. Isachsen's contemplated expedition has for its objective the exploration of Spitzbergen, should sufficient funds be obtained for the purpose. As a companion of Captain Sverdrup's in his last expedition, Captain Isachsen has experienced some of the difficulties which lie before him in such an undertaking, and is no doubt prepared to overcome them with that determination and courage characteristic of most of his compatriots. There is yet another Arctic enterprise in contemplation, and this is associated with the name of Mr. Lefingwell, who was Mr. Nickelsen's partner in the expedition organised to search for a Polar continent. Mr. Lefingwell is arranging for the resumption for another three or four years of his investigations into the geography, geology, and ethnology of the whole area extending from the Mackenzie River to Alaska.

In Australia, there is nothing of special interest to record in the way of exploration and discovery. The country is now being examined with the object of building a transcontinental railway to connect the eastern and western States. This enterprise is in the hands of the Commonwealth Government, who, it is hoped, will see the undertaking completed. Australia would then be in line with South Africa, whose railway system extends from the Cape to Cairo.

Following the usual course adopted for several preceding years, the Council desires to recommend:—(1) The suspension of so much of the rules as provides for the payment of an entrance fee; (2) the reappointment of Mr. A. S. Kennedy as Hon. Librarian, and of Mr. Robert Fraser as Hon. Auditor; (3) the reappointment of Messrs. Alexander Muir and Robert Fraser as unofficial members of the Council; (4) the appointment of Mr. J. A. Beal as Hon. Lanternist.

The Council, in warmly thanking all who have so ably and loyally contributed to the success of the past session by the reading of valuable and interesting papers, or in other ways, desires to again express the obligations of the Society to Mr. A. S. Kennedy, the Hon. Librarian, and Mr. Robert Fraser, the Hon. Auditor, whose long and faithful services are greatly appreciated. The thanks of the Council are also due to Mr. E. C. Barton, M.L.A., to whom the Society is beholden for efficient representation at the Ninth International Geographical Congress held last year at Geneva, and to Mr. J. A. Beal for valuable services rendered at the monthly meetings.

In concluding this report, the Council feels it a duty to voice the general feeling of the members at large in giving expression to their high appreciation and admiration of the splendid services rendered by the retiring Vice-President, His Excellency the Honourable Sir Arthur Morgan, who for many years has so worthily filled the vice chair and identified himself with the activities of the Society with such unusual zeal, enthusiasm, and energy, as to merit the gratitude and appreciation of all.

ABSTRACT OF THE ACCOUNTS OF THE ROYAL GEOGRAPHICAL

Dr. From 1st July, 1908,

	£	s.	d.	£	s.	d
By Funds at close of last Account—						
,, By Balance in Government Savings Bank	34	15	6			
,, ,, Royal ,, ...	46	8	2			
				81	3	8
,, Annual Subscriptions received	148	0	6			
,, Interest on Government Savings Bank Deposit ..	1	0	5			
				149	0	11
				£230	4	˙

Examined with Bank Pass Books, Vouchers, etc , and found correct.

ROBT. FRASER,
Hon. Auditor.

11th July, 1909.

SOCIETY OF AUSTRALASIA, QUEENSLAND.

to 30th June, 1909. Cr.

	£ s. d.	£ s. d
To Expenditure as per Accounts—		
,, Printing " Journal "	50 14 5	
,, Postage on " Journal "	5 19 0	
		56 13 5
,, General Postage, Printing, and Notices of Meetings ..	32 16 4	
,, Hon. Treasurer	26 5 0	
		59 1 4
,, Gas Account	4 2 6	
,, Fire Insurance Premium	18 9	
,, Sub. to "Nature" and P.O.O.	1 11 6	
,, Hire of Chairs	2 6 0	
,, Expenses of Meetings, Cleaning Rooms, Stationery, etc.	31 2 3	
,, Cablegrams	2 12 0	
		42 13 0
,, Bank Charges		11 0
		158 18
,, Balance in Government Savings Bank	35 14 11	
,, ,, Royal ,, ...	35 10 11	
		71 5 10
		£230 4 7

J. P. THOMSON,
Hon. Secretary and Treasurer.

AN APPRECIATION.

The following leading article appeared in the *Warwick Argus*, of August 3rd, 1909, and is reprinted for the information of the Fellows and Members of the Royal Geographical Society of Australasia, Queensland :—

The Royal Geographical Society of Australasia (Queensland), whose annual meeting took place in Brisbane a few evenings since, has certainly strong claims to be regarded as a national institution in the truest sense of the word. It is one of the misfortunes attaching to our present system of education—or perhaps one should say the system which prevailed until within the past few years—that, to many of us, geography has been made distasteful by its association with the irksome task of committing to memory long and uninteresting lists of names of mountains, rivers, and states, with which the student has too often been unable to connect one single idea of living interest. It is now becoming recognised that geography, when properly taught, is at once absorbing in its interest and invaluable in its bearing upon the business of life. But the definition of the term is vastly wider than it was half-a-century ago ; and it now embraces almost everything that can be known of the countries of the globe and of the people who inhabit them. It is of the utmost importance that we in Australia should be kept in touch with what is done in other parts of the world in geographical study and exploration ; and it is even more important, from many points of view, that we should see to it that others are made acquainted with the geography of this country.

In the three aspects indicated, the Royal Geographical Society is doing good service for the State. From an educational standpoint, it is certainly popularising the study of geography by means of the highly interesting papers prepared by its members and others, and almost invariably illustrated by excellent lantern views. By its exchanges with other scientific societies throughout the world, the Geographical Society has brought together a very large collection of contemporary literature on its special branch of learning ; and its own proceedings, distributed in return, are received and appreciatively studied in every civilised country. Here is a ground upon which the Society and its enthusiastic secretary, Dr. J. P. Thomson, may justly claim the active interest and support of all who have any special knowledge of the features of our own country. The list of papers read during the past few years will show the wide range of subjects dealt with, and might easily suggest to travellers,

or to residents in the little known parts of our Continent, that they also are possessed of information which, if placed at the disposal of the society, would be eagerly read, not only in our own limited circle, but in other parts of the world, wherever geography is studied.

An excellent illustration of this was provided at the annual meeting by the remarks of Mr. George Phillips, C.E., who has been appointed to the important position of Vice-President of the Society Mr. Phillips has just returned from an extended examination of the country in the Gulf districts, with a view to railway extension; and no doubt when he has sent in his official report, we may look for some highly valuable work for the Society from him. It is, after all, with our own country that the Geographical Society is mainly concerned, and it is regarding our own country that the reports of its proceedings will be searched by scientists abroad Mr. Phillips' references to the magnificent running stream of the Gregory River, to the splendid downs country traversed by him, and to the enormous value of the natural grasses of the interior of Queensland, found sympathetic listeners among Southern visitors who had happily been invited to attend the meeting. These statements prompted also the remark of the retiring Vice-President, Sir Arthur Morgan, that in wool alone the States were indebted to their indigenous grasses for an annual income of some 25 millions, and that was but one item in the return derived from this source.

The necessity for still greater activity in the work of geographical investigation was emphasised by Mr. Phillips, who remarked that scarcely 5 per cent. of our prominent mountains had been charted, and but few of our rivers had been thoroughly surveyed. It is obviously impossible to make proper use of the natural wealth of the country until more is known of its actual features; and in the matter of water conservation alone, it is of the utmost consequence that knowledge should be acquired and collated, so that it may be seen where the opportunities exist, and waste of money on inferior schemes may be avoided. Latterly, the Government of Queensland has been engaged in certain investigations in this particular direction, and the public will look with no little eagerness for the reports of the surveyors who have been engaged in this exploratory work. At the same time, it may be suggested that any man who has spent even six months in the less frequented parts of Queensland on such work as this, has necessarily accumulated a found of information which could not possibly be embodied in any official document, but which could be made available in a paper for the Geographical Society.

The scope of the Society's correspondence is illustrated in the annual report by the very interesting summary given of exploration

work in progress in all quarters of the globe. In the course of a few brief pages the secretary has been enabled to demonstrate the enormous activity now being displayed in penetrating hitherto inaccessible places of the earth, such as Thibet and Assam, the Himalayas, the Eastern Sahara, and the previously unopened parts of South America, to say nothing of the world's standing geographic problems in the Polar regions, to which so important a contribution has lately been made by Lieutenant Shackleton and his colleague, Professor David, of the Sydney University. Yet it has to be said that "in Australia there is nothing of special interest to record in the way of exploration and discovery." One cannot escape the conclusion that in this fact we have a reflection on the enterprise, or perhaps we ought to say, the imagination, of Australian legislators. Whilst so vast a proportion of the map of Australia remains to be filled in, we cannot afford to fold our hands in idleness, or devote all our attention to the coast districts. Even within a few hundred miles of Warwick there are places of which but little is as yet known, so far as any published map is concerned; but knowledge is being extended, and it is through such agencies as the Royal Geographical Society that the information possessed by individuals may be gathered and made available for the public. In this way, too, the advisableness of reserving certain tracts to serve as national parks has been enforced, The claims of the Lamington Plateau, on the Southern border of the State, to be regarded as a health resort for future generations have been advocated in more than one paper read before the Royal Geographical Society, and it is gratifying to find that not only this magnificent area, but also two others nearer to Warwick—embracing Cunningham's Gap and Mount Dumaresq respectively—have been reserved; also a fine area on the Bunya Range near Dalby, and others on the North Coast.

The Royal Geographical Society has reached an important stage in its history. During the coming year it will have attained its 25th anniversary and in celebrating the occasion it will have the advantage of the assistance, as its President, of the Governor of the State, Sir William MacGregor, who has certainly done more in the exploration of New Guinea than any living man, and whose sympathy with the aims of the Geographical Society is a matter of many years standing. Sir Arthur Morgan, who has rendered the Society conspicuous service during his comparatively long term of office, has retired from the Vice-President's chair; but he loses nothing of his keen interest in the work of the Society, and he retains his seat on the Council. It will be remembered that some years ago Sir Arthur was instrumental in inducing the Society to hold some of its meetings

on the Downs, and it may be hoped that in any arrangements which may be made to celebrate the 25th anniversary, it will not be forgotten that the people of the Darling Downs have a keen interest in geographical problems of Queensland, and that there are natural features in this part of the State which might well command the attention of the Council and members of the Society.

THE KAFFIR KRAAL.

When one views the krall or home of the Kaffir for the first time, your mind goes back to the camp of the Queensland black-fellow ; with its upright sheets of bark. a few spears stuck in the ground in front, a collection of mangy dogs camped inside the gunyah. That picture comprises very unfavourable with the neat home of " Johnny Kaffir." The krall resembles in shape the old-fashioned English bee-hive or an enormous straw inverted basin. A small court yard with clay floor and walls is built in front, covered with coloured assigais in white and blue of an Egyptian character. How this South African black-fellow got the idea of these ornamentations in the first place leaves great scope for one's imagination. If in ages past some wandering artist from the Nile traversed down South, and the designs were used from tribe to tribe until they reached the present Transvaal ; or artistic sailors passed them along the seaboard leaves great scope for conjecture. The Kaffir is fond of his home, the water-gourds hung in front, the skins spread on the clay floors, give the krall an air of neatness generally wanting in a savage's camp. For some reason of his own the Kaffir camps far from the water. Perhaps in the early days too many wild beasts came down to drink at night, or the bed of the donga (or creek) gave too much cover to the approximate foe. So every night before dark a long string of Kaffir women, wearing highly coloured rugs, carrying an enormous calabash well balanced on their head, can be seen going to the water, or to the nearest spruit (or water hole)—a most picturesque sight. The ornamentations of both sexes consist of beads and wire work, and very clever work at that. The mixture of coloured beads, the twisting in and out of steel and copper wire of the intricate patterns. The splendid finish makes the whole thing a marvel of barbaric workmanship. So taking the Kaffir all through, his artistic home, his ornaments of wire, the patch of mealies (or Kaffir corn) at the rear of his cluster of kralls (no Kaffir builds by himself) ranks the home life of this black savage high among all black nations. For when on the warpath, he is blood-thirsty and savage enough, and during the last war all though he was supposed to keep neutral many an isolated Boer commando was " wiped out " when a time back shomboking (or flogging with native whip) was revenged, and many an act of vengeance was planned (well carried out afterwards) under the peaceful shade of the " Kaffir Krall."

" OUT WEST."

THE LAST BORA ON THE WEIR RIVER.

The following interesting correspondence is taken from "The Warwick Argus," Sept. 27 and Oct. 13, 1908 :—

QUAINT ABORIGINAL CEREMONY.

Mr. Donald Gunn, M.L.A., of Boolarwell, near Goondiwindi, sends us an interesting description of the last "Bora," held by the blacks of the Weir and Barwon country. It took place at Tallwood in 1893—fifteen years ago—and Mr. Gunn was permitted to witness some of the dances in connection with the ceremony. His account of what he saw is given below.

THE "BORA" CEREMONY.

The name "Bora" is derived from "Bor" or "Boora," the belt of manhood and is conferred on the neophyte of life entering that stage. This "bor" is supposed to be endowed with magical power, so that by throwing it at an enemy sickness can be ejected from the body of a thrower. It is the great national institution of the Australian aboriginal, the right of initiation into the duties and privileges of manhood. The sacredness of this immemorial rite— and the indispensable obligation to submit to it, are (says the writer of an article on the subject in the "Australian Dictionary of Dates," from which we quote) most deeply impressed on the minds of the young aboriginals. Even when they enter the service of the squatters or the settlers, and so in a great measure break off from association with their own people, they seem to be bound by an irresistible spell to submit, at the presented time, in spite of all obstacles and dissuasions, to their national rites. The "Bora" is held whenever there is a considerable number of youths of an age to be admitted to the rank of manhood. Rev. William Ridley, an authority on the subject says :—"Old Billy Murri Bundarat Burturgate stated that the Creator 'Baiame' long ago commanded the people to keep the 'Bora,' and gave them the Dhurumbulum, or sacred wand, for this purpose. He said any one of the men might demand that a 'Bora' be held. Then they consult as to the place, and chose one of their number to be the dictator or manager of the solemnity. This dictator sends a man round to all the tribes, who are expected to join in it. This herald bears in his hand a boomerang and a spear with a murura (padymelon) skin hanging upon it. Sometimes all the men within twenty miles are summoned, sometimes a much larger circuit is included, and Billy stated that everyone summoned must attend the 'Bora,' even if he had to travel a hundred miles to it. It is so done, he said, all over the country, and always will be. The dictator chooses a suitable spot for the purpose, and fixes the day for the opening of the ceremony. The ground is regarded as consecrated to 'Baiame,' and his will is obeyed in carrying out the service. Notice is given three weeks at least, sometimes three months before the ceremony begins ; during the interval the trees on the chosen ground are ornamented with figures of snakes and birds cut with the tomahawk. When the appointed time is come the men leave their camps, where the women and children and youths remain. The men assemble at the selected spot, clear away all the bushes, and make a semi-circular embankment or fence ; this being done some of the men go to the camps, pretending to make a hostile attack, on which the women run away with their

children—the young men and boys over 13 go back with the men to the 'Bora'. Very few Europeans have been allowed to witness the ceremony, but a Mr. Honey, when a boy, was present at one held between the Barwon and Castlereagh Rivers, and has given a description of it, but the proceedings and ceremonies appear to differ widely in the different tribes, the discipline the candidates for manhood have to go through in some tribes being far more severe than in others, so much so that the young men, after undergoing the severity of the ordeal, are quite exhausted, and sometimes half-dead. Previous to undergoing the ordeal, the candidates have to be for seven or eight months under a strict rule, eating only prescribed food, and keeping themselves partially secluded from social intercourse. The day of the ceremony having been decided on and the tribes assembled, a place is cleared and prepared generally on the top of a low hill ; here the youths are kept for a week under the surveillance of two or three old men ; at the end of this time one of the front teeth is knocked out and the youths receive a severe flogging, during which tortures they are not expected to groan or display any signs of pain. For the next four days (in some tribes) their food is of the most revolting description that can be imagined. After the last ceremony the young men are allowed to go away. For three or four months they are not allowed to come within three hundred yards of a woman, but once in the course of the time a great smoke is made with burning boughs, and the young men are brought up to one side of it, whilst women appear at a distance on the other side. Then the young men go away for another month or so ; at the end of that time they again assemble and take part in a sham fight ; this completes the long process of initiation. From this time they are free to exercise all the privileges of manhood, amongst which are the eating of the flesh of kangaroo and emus, and the taking of wives. During the intervals between the ceremonies of the 'Bora' the candidates are carefully instructed by the old men in the unwritten laws or traditions of their tribe and the laws of consanguinity and marriage, a breach of which latter moral law subjects the offender to the risk of death. The ceremonial of the 'Bora' is the great educational system by which this exact observance of their law is inculcated.'

MR. GUNN'S ACCOUNT.

The last "Bora" held on the Weir River (says Mr. Gunn) took place in 1893. The blacks had been talking about it for months, until I began to think they were romancing. But one day a party of strange blacks put in an appearance, and during the ensuing two months fresh "mobs" turned up at intervals, until at last there must have been quite 150 camped on the banks of the Weir, not far from Tallwood. They brought all the money they possessed with them, and bought rations as long as their capital lasted ; then they begged, and after that stole a few sheep as hunger urged them and opportunity presented itself. They bought or begged all the raddle the squatters could be induced to part with, and used it to decorate their bodies for the dances in connection with the coming ceremony.

had the honour of receiving a special invitation to inspect the "Bora" ground and witness some of the dances. The ground was situated four miles to the north of Tallwood. The blacks had cleared a space of about half an acre in the scrub, and in the centre of this they had formed a ring about the size of a large circus ring. Old "Steve," king of the tribe, acted as master of the ceremonies. He was all importance on so great an occasion, but he was politeness itself to me, and I was given a place of honour at the ringside from which an excellent view of the proceedings could be obtained.

Presently the old men and the warriors came prancing into the ring from the thick bush close by, where up to now they had been busy decorating themselves with raddle and pipe-clay. Save for the briefest of loin-cloths, they appeared in "the altogether," recalling one of Kipling's characters—

"The uniform he wore was nothing much before,
And rather less than half of that behind."

No two of the blacks were painted exactly alike. Their hair had, with the aid of pine gum or resin, been made quite stiff, and into these masses of hair and gum cockatoo and other feathers had been stuck and made to stand erect, giving the men a decidedly fantastic appearance. As they danced, they chanted what seemed to me the most weird songs—something between the plaintive call of a curlew at night and the wailing but not unmusical cry of a dingo.

The young men awaiting initiation were meanwhile seated beside the ring on pieces of bark, each taking care that no part of his body should touch the ground. The old men and the "warriors" continued dancing and prancing around the ring for some time, keeping excellent time in step and gesture, as they went through movements of what seemed to me to be a sort of savage physical drill. By-and-by there was a pause for a moment, the boys rose from their bark mats and joined the old men and the "warriors," and the dancing and chanting were resumed and the figures repeated. Presently the gins appeared upon the scene, gathering at the circumference of the ring and throwing gum leaves over the dancers as they passed.

A queer path led from the large ring beside which I was seated, and in which the performances already described took place, to a smaller ring some distance away in the scrub—but neither the whites, the gins, nor the young men were allowed to go near this spot, which seemed to be regarded as the "holy of holies" of the Bora ground.

After the performances I have described had been repeated daily for a considerable time—for some months, the blacks told me—all the old men and the gins left the Bora ground, and they told us that the young men had gone away to the bush with the "warriors," that they would remain away for two weeks, and then return to a bough-yard which was to be built in the meantime at Newinga, the adjoining station 7 miles away. Just before two weeks expired all the old men, ths gins, and the children set out for Newinga, where they built a yard of boughs something like the "break" which a drover makes to hold sheep at night, but rather more in the form of a crescent.

At the appointed time the young men and the braves turned up at Newinga, but when they saw the gins seated under the boughs they simulated fear and ran away into the bush again. They returned on the following day, however; and this time there was no pretence of being afraid. Husbands and wives greeted each other with wildest demonstrations of joy, and the young men were given wives, or rather allowed to take the girls of their choice. It had no doubt all been arranged beforehand between the young people, otherwise there would surely have been fighting. There was, on the contrary, a great feast as a finale to the ceremony, and in the course of a few days the tribes were scattered to the four corners of the country which they roamed and fished and hunted—never to meet agaid for a "Bora." Most of them have since gone to the happy hunting grounds. The scrub has been cleared, and very few trees now remain at the old "Bora" ground. Tallwood will never witness such a ceremony again.

A few days after the blacks had left the "Bora" ground at Tallwood, I returned to have a look at the smaller ring which we were not permitted to visit while the ceremonies were in progress. The two rings were about 200 yards apart, and on the right side of the path leading from the big ring to the small one was the longitudinal section of a hollow log about 6ft. long, with the round side uppermost. At one end of this the skull of a bullock had been fixed with mud, while at the other end was a horse's tail similarly attached. On the other side of the path was an effigy composed of an old shirt and trousers stuffed with grass. Further on, near the entrance of the small ring, was the nude figure of a man, fashioned out of mud, lying on its back, and just opposite was the similar figure of a woman, also lying on its back. The bark of the trees surrounding the small ring had been carved into all manners of patterns, and the figures of birds and animals peculiar to the locality had been drawn on the ground by the artists of the tribes.

As far as I could gather from the old blacks, all the tribes within reasonable distance used in the olden times to meet for these "Bora" ceremonies on what for the time was regarded as neutral ground. The purposes of the "Bora" were many. There was the initiation of the young men, already mentioned, and there was bartering for weapons—the stone implements made in the hill districts being exchanged for the boomerangs, etc., that were made on the plains. The young men underwent a course of training, and were taught how to sing, dance, and hunt—they were not considered to be men until they had gone through a "Bora," nor were they allowed to marry. Laws were made for the good government of the tribes, and for the protection of the game on which they depended for their food supplies. For instance, if any kind of game was getting scarce—kangaroos, for example—it was decreed that no more kangaroos should be killed until the next "Bora," thus giving the animals time to breed up.

Possibly some of those who claim to be versed in aboriginal lore will declare that the blacks do not do all the things which I have described, or as I have described. I can say that the description given above was written just after I had witnessed the ceremony, and that it is an accurate account of what I saw and heard. A photographer happened to be passing through the district while the dances were in progress, and I got him to photograph the blacks in their "warpaint," but I am sorry to say the picture was not a success.

THE LAST BORA AT MARYLAND.

FORTY YEARS AGO.

Mr. George Bamberry, of Marlow, in the Stanthorpe district, writes us as follows :—

I read with much interest the account of the last "Bora" ceremony held by the M'Intyre blacks on the Weir River, which Mr. Donald Gunn, M.L.A., contributed to the "Argus" a few weeks ago. Mr. Gunn seemed to think that some people might be disposed to question his recollection of what he saw on that occasion. Well, I know a good deal about the blacks—having lived in close contact with them for many years—and my observations of their manners and customs lead me to believe every word Mr. Gunn has written.

One day when I was a boy of fourteen I was out shooting cockatoos on Maryland run. I had followed a flock of the birds for three or four miles, when all at once I emerged from the thick forest on to a cleared space in the centre of which there was a big run. It soon became clear to me that I had stumbled on to the Bora ground of the Maryland blacks. Mr. Gunn's description of the Weir River Bora ground exactly fits what I saw. On the crown of a level-topped sandy hill there was about 150 yards of what diggers call a " blow up," very steep on the sides, and on the top of this there was about an acre of level land surrounded by dense scrub, in the centre of which the blacks had cleared a space and formed the little ring. From the big ring on the sandy hill to the little ring on the top of the " blow up," there was a track about 250 yards in length. It wound round the hill and went up at the back of the " blow up " to the little ring. One might have gone as close as thirty or forty yards without seeing the little ring, or being able to see anything that was going on in it. The only real difference between what Mr. Gunn saw on the Weir and what I saw at Maryland was that there was a road or track full 30 feet wide, properly cleared and excavated to a depth of six inches, connecting the two rings. The Bora ground was situated about a mile east of Ruby Creek, close to where we discovered tin in 1872, and there were plenty of signs that it had been used for ceremonial purposes not long before I happened upon it. A young blackfellow, from whom I made inquiries, informed me that the last Bora had been held there about a year before. There are traces of the Maryland Bora ground visible even to-day, but there are few traces left of the poor blacks themselves. The white man's civilisation has " civilised " them out of existence.

Maryland was a sort of meeting place for the blacks in the early days. They used to come from the low country along the Severn and M'Intyre from Texas to the plains west of Goondiwindi, and from the hill country on the east or coast side. On the occasions of corroborees or tribal fights it was not an unusual sight to see from 200 to 300 of them assembled. Once I saw a sham fight between about forty or fifty young " bucks," and it was well worth seeing. They approached in extended order, and when the lines were about 25 yards apart the warriors opened fire with nullas and other weapons. In addition to weapons of offence, each carried an eelaman, and the skill with which they used these latter to ward off the weapons thrown by the enemy—and the weapons were thrown with force and precision—was simply marvellous. When all their weapons was thrown there was a truce for a while, the weapons were collected, and the " fight " began again. It was, I repeat, a fine sight to see them using their eelamans to ward off flying nullas ; at other times they jumped into the air or to one side to avoid a blow that would have meant serious injury. Their sight was equal to their agility, and I never saw one hit in these sham fights.

During the time I lived at Wylie Creek the blacks had three fights, two of which I saw, and also several corroborees. In one of these fights they used only nullas, in the other nullas and boomerangs. I asked one of the old men why they did not use their spears as well. He told me that for certain offences they had to fight with certain weapons, and that they only used spears when the cause of war was the most deadly offence. Wiley Creek was also a trading place. The Western blacks brought with them large numbers of spears and boomerangs made from myall, while the blacks from the east brought eelamans. There is no myall on the eastern side, and there is no suitable timber for eelamans on the western side ; so they each brought the products of their respective districts and used them for the purposes of barter and exchange.

The different tribes had different laws. For instance, the western blacks knocked out a front tooth, but this practice was not observed in the eastern districts.

I have said that the Maryland blacks had held a Bora not long before I discovered their ground. That was the last ceremony of the kind held by them —this I can say from personal knowledge. And now there is only a single individual of that once numerous tribe left. They have been "wiped out" in less than forty years

I have in my possession a relic of the olden times in the shape of an aboriginal king's breast-plate. It is crescent-shaped, made of copper, and is ornamented with drawings of kangaroos and emus, boomerangs, spears, nullas and other aboriginal weapons. And it bears the following inscription: "From John Deuchar to George (or 'Noondoo'), 1860." The John Deuchar referred to was a former owner of the famous Glengallan station. (And father of Mrs. Donald Gunn, of Boolarwell, Goondiwindi.—Ed.)

ABORIGINAL BURYING CUSTOMS

At Pikedale, where I spent most of my life, the aboriginals buried their dead in the ground. I have seen the graves when they were newly-made, and they looked like ant-beds. I was told the corpse was put in a hole in the ground in a kneeling position, and the ground filled in and heaped over the head.

Aboriginal Burying Ground near Boolarwell. Corpses deposited in Hollow marked "A."

From Goondiwindi to here and on to the other side of St. George, they used to drop the dead bodies down hollow trees, and if the tree was a good one for the purpose they kept on using it until it was full.

Tree near Boolarwell containing Corpses of Aboriginals. Corpses were dropped in Hollow marked "A."

Just near here, in one of my paddocks, were two favourite trees of which I enclose photos. On my sons' place the other side of St. George I know of another favourite tree full of bones; you can climb up the two trees here and see the bones in the hollow. Since I have been here they have buried their dead in the ground.—Donald Gunn.

Royal Geographical Society of Australasia,

QUEENSLAND.

FOUNDED 1885.

DIPLOMAS OF FELLOWSHIP.

The following gentlemen have been awarded the Diploma of Fellowship under Section IV. of Clause 3, Constitution and Rules (*See page 2 of Cover*):—

Honorary:

His Excellency Sir William MacGregor, G.C.M.G., C.B., M.D., LL.D., D.Sc., Hon. F.R.S.G.S., etc.

The Right Hon. Lord Lamington, G.C.M.G., G.C.I.E., B.A., F.R.G.S., Hon. F.R.S.G.S., etc.

Under subsections (a and b):—

Lieut.-Col. James Irving, P.V.O., Q.D.F., M.R.C.V.S.L.
Charles Battersby, Esq., J.P.
Robert Fraser, Esq., J.P.
E. M. Waraker, Esq., J.P.
R. M. Collins, Esq., J.P.
Alexander Muir, Esq., J.P.
C. B. Lethem, Esq., C.E.
John Cameron, Esq., M.L.A.
Hon. Sir Arthur Morgan, Kt., F.R.G.S., etc.
Hon. C. F. Marks, M.D., M.L.C.
Hon. F. T. Brentnall, M.L.C.
James Stodart, Esq., M.L.A.
J. R. Atkinson, Esq., L.S., J.P.
L. F. Schoenheimer, Esq., J.P.
Ald. John Crase, J.P.
L. C. Horton, Esq., J.P.
J. T. Embley, Esq., L.S.
Rev. L. L. Wirt, B.D.
Capt. W. C. Thomson.

LIST OF MEMBERS.

(P) Members who have contributed papers which are published in the Society's "Proceedings and Transactions." The numerals indicate the number of such contributions.

(PP) Past President.

A dagger (†) prefixed to a name indicates a member of the Council.

Life members are distinguished thus (*).

Should any error or omission be found in this list, it is requested that notice thereof be given to the Hon. Secretary.

Foundation Members

P1 Atkinson, J. R., J.P., FELLOW, Lic. Surveyor, Ipswich, Queensland.

Marks, Hon. C. F., M.D., M.L.C., FELLOW, Wickham Terrace, Brisbane.

P1*Moor, T. B., F.R.G.S., F.R.S.Tas., Strahan, West Coast, Tasmania.

P1†Muir, A., J.P., FELLOW, 354 Queen Street, Brisbane.

P36PP*Thomson, J. P., LL.D., Hon.F.R.S.G.S., etc., Hon. Secretary and Treasurer, Wood Street, South Brisbane.

Members:

Affleck, Thos. H., "Westhall," Freestone, Warwick, Q.

Aldridge, H. E., J.P., "Baddow," Maryborough, Queensland.

Alford, Henry King, J.P., "St. Audries," Toowoomba, Queensland.

Allan, David Muir, Engineering Supply Co. Ltd., Edward Street, Brisbane.

Allom, C. V., c/o B. P. & Co., Normanton, Q.

Alison-Greene, Miss Alice J., Moreton Bay Girls' High School, Wynnum.

Archer, Edward Walker, J.P., M.H.R., Targinnie Station, Yarwun, Queensland, and Parliament House, Melbourne, Victoria.

2 Banfield, Edmund James, J.P., Brammo Bay, Dunk Island, via Townsville, Queensland.

*Barrett, Mrs. Walter, Eagle Junction, Brisbane.

†Barton, E. J. T., Bowen Terrace, New Farm, Brisbane.

†Barton, E. C., New Zealand Buildings, Queen Street, Brisbane.

Battersby, C., J.P., FELLOW, Georgetown, Queensland.

Baynes, Harry S., Water Street, South Brisbane.

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TIDES I.*

By Capt. J. F. RUTHVEN, R.N.R., F.R.G.S.

Although the cause of tides has been a subject of speculation during countless centuries, Sir Isaac Newton was the first to evolve a theory worthy of the name. It was a direct result of his discovery of Universal Gravitation, and must have been in the first instance mainly, if not wholly, statical. A theory to be of any practical use in explaining natural phenomena must bear some sensible resemblance to observed facts, and the only available tides of which there was any record in Newton's time seemed to emphatically contradict the Equilibrium Theory, which was amongst the first results of the great philosopher's epoch-making discovery.

Newton's effort to reconcile theory with observation led to the 18th and 19th corollaries, Prop. 66, Book I of the Principia, which I have elsewhere shown†, and are now admitted to be untenable. This introduction of dynamics into the problem, led Laplace in the following century to discard the statical element altogether, and promulgate the dynamical theory, which has ever since been the received theory of the world.

Sir George Airy, a great mathematician and astronomer royal, described the Equilibrium Theory as "one of the most contemptible theories ever applied to explain a collection of important physical facts," and "as entirely false in principles and entirely inapplicable in results," but I hope to show that it was only because he misinterpreted it, that he pronounced this scathing condemnation. The mathematical world then believed that Laplace's theory would explain everything, but so far from this being so, Nature contradicts it at every step, and the greatest tidal expert of the day has had

* Read at the Royal Geographical Society of Australasia, Queensland, Sept. 23, 1909.

† Moxly's Theory of the Tide by J. F. Ruthven, published by Potter, 145 Minories.

to resuscitate the Equilibrium Theory up to a point, to help him out of difficulties that Nature puts in the way of the received theory. Even then he has to admit that both " theories must be abandoned as satisfactory explanations of the true conditions of affairs," and the tidal experts trust to the analysis of actual tides, which they fit in as best they can with theory. I will now endeavour to make it clear to the reader that the dynamical theory is false in principle, and that the Equilibrium Theory correctly interpreted is capable of explaining the phenomena of the tides on the ideal world assumed by Laplace (one completely covered with water of uniform depth), and on our own globe as far as obstructions will permit. For simplicity I will deal only with the lunar tides, but the sun produces tides in exactly the same manner, which are easily combined with those formed by the moon.

The Professor already quoted describes tide as " a rising and falling of the water of the ocean, caused by the attraction of the sun and moon." I accept that definition, merely remarking for the benefit of the reader that it is not the total attraction that raises the tide, but the difference between the attraction on the particles composing the earth. The total attraction of all the particles in the moon may be supposed to be concentrated in her centre, and the attraction on each particle of the earth varies inversely as the square of its distance from this centre. Of course the earth similarly attracts the moon, but as we are not dealing with moon tides, that does not affect our present subject, except that this mutual attraction or centripetal force would bring the two bodies together if it was not counteracted by another force, which must necessarily be equal to it on the whole, and on the average. This is the centrifugal force of revolution, and it differs from the centripetal force in that it is the same for every particle of the earth, and herein lies the sole cause of the tides which seamen utilize, and mankind in general receive so much benefit from.

To get a clear idea of the action of these forces, let us assume for the present that the earth is non-rotating, and in the annexed

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EXPLANATION OF DIAGRAM.

The circle is a section of the earth, with the point A vertically under the moon. The earth's gravity attracts every point equally towards T.

The moon is 60 radii of the earth, distant from T in direction M.

G is the common centre of gravity, about which they both revolve.

On either side of A is shown a typical row of particles, of which there are an infinite number of rows, all radiating from A.

The earth and moon are kept from separating by their mutual attraction or centripetal force, which is exactly balanced by the centrifugal force of revolution.

Whilst these two forces are equal on the whole, and on the average, they are not the same for every particle of the earth.

The centrifugal force has the same magnitude and direction for each particle of the earth, and acts in parallel lines, either along AB or parallel to it.

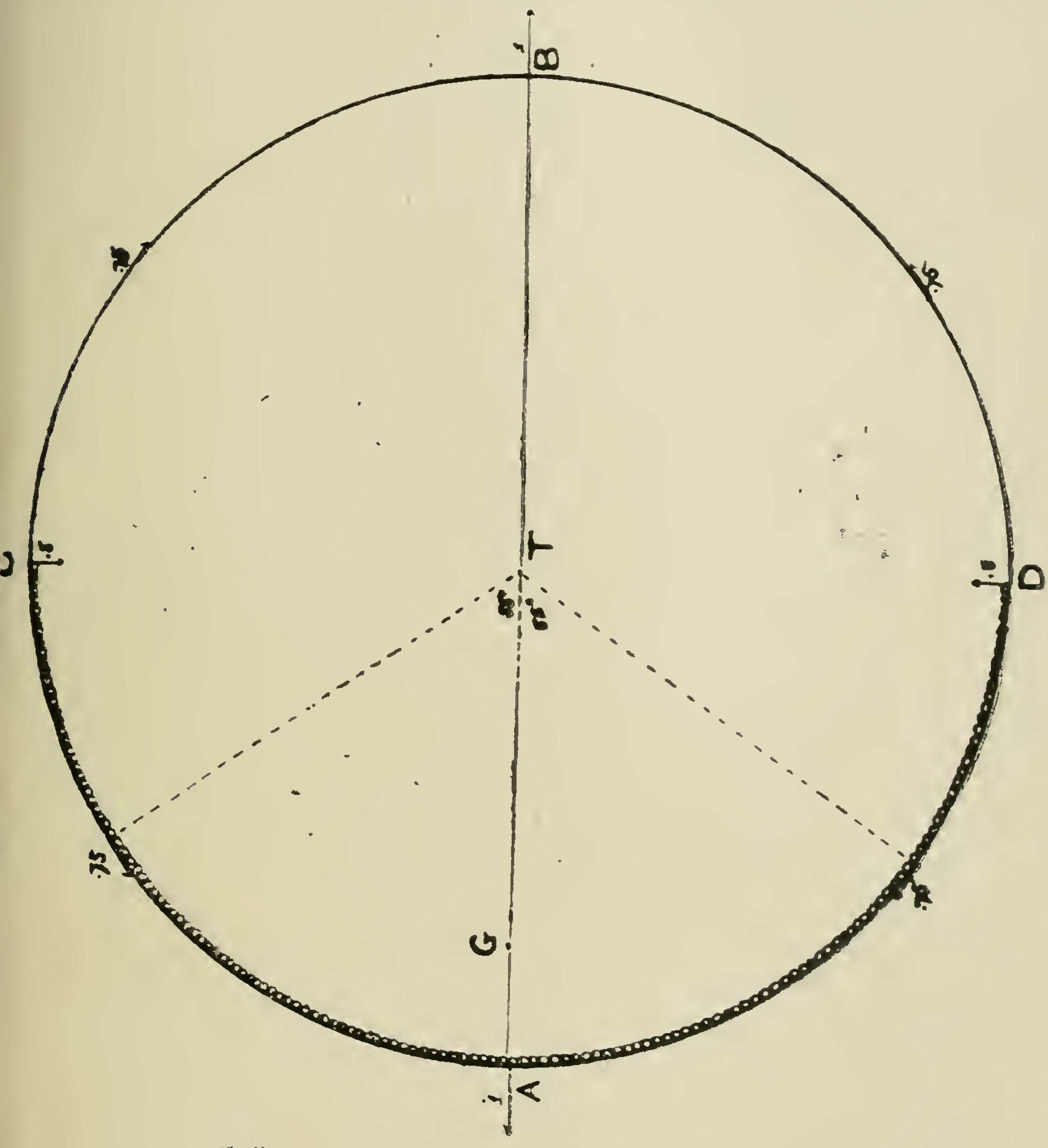


DIAGRAM to illustrate how The Differential Attraction of the Moon produces the Tidal Cone.

M ← DIRECTION OF MOON

The attraction towards M is greatest on the particles at A. As the distance from A increases the vertical attraction on each particle is less, but simultaneously the tangential pressure increases continuously towards A, till the circle of mean level 54° 44′ from the apex is reached. Then the tangential pressure towards A decreases and downward pressure assisting the earth's gravity begins.

The lines of centripetal force being directed to the moon's centre converge slightly, and the attraction varies inversely as the square of the distance of each particle from that centre.

Whilst these two forces must be equal, and balance one another at T (and practically all along the line CTD), it is quite evident that A, being so much nearer the moon, centripetal will be stronger there than centrifugal force, and that at B centrifugal force will be stronger.

These "overbalances," as they are called, are the tide raising forces, or tide generating forces.

At A the tide raising force is a maximum, and acting at right angles to the earth's surface in opposition to her gravity.

It can be easily demonstrated that at C and D the force will be just half what it is at A and normal to the earth's surface, but acting inwards.

At 54° 44′ from A the force is three-fourths of the maximum, and acting wholly tangentially.

At all other points it has intermediate values, and acts more or less obliquely, but can be resolved into rectangular components, acting normally and tangentially.

Between C and 54° 44′, it acts partly inwards, and partly tangentially. Thence to A it acts tangentially and outwards.

As the moon's influence is thus to raise the water at A by counteracting the earth's gravity, and to lower it at C and D by assisting the pressure of the earth's gravity, and as from A to both C and D, her attraction gradually decreases its effect in reducing the pull of the earth's own gravity, and so produces the tangential pressure towards A, it must be evident that the whole tendency is to raise a cone of water, the apex of which will be at A, where all the pressures meet. The tangential pull is assisted by the convergence of the lines of centripetal force. The particles press one against the other, and there is no necessity for any surface current as required by the dynamical theory.

The overbalance of centrifugal force produces similarly another cone at B, but it is slightly smaller, because the tide raising force varies inversely as the cube of the moon's distance.

---

diagram let the circle CADB represent a section of the earth of which T is the centre, and A the point under the moon. Then every particle on the circumference (assuming the earth to be a sphere), will be attracted equally by the earth's gravity towards T. The moon being 30 diameters of the earth distant, her attraction at C, D and T will be practically the same and equal to her average attraction, which exactly balances centrifugal force. It will be evident that at A the moon's attraction will be a maximum, and that its whole effect will be expended in diminishing the attraction towards T, and there will be an overbalance of centripetal force in the direction of the moon. As we move round the circumference from A towards C and D, the moon's attraction decreases in the ratio of the inverse square of her distance, which is equivalent to an increase in the pressure towards T, and this squeeze produces the lunar cone. Again at B it is evident that the moon's attraction is a minimum, and there will be a similar overbalance of centrifugal force which forms the anti-lunar cone. This is how we contend the tidal cones are generated and equilibrium maintained by differential pressure which acts instantaneously. Even with rotation in abeyance these two cones would travel round the earth in

company with the moon once in a lunation, and they account for the whole tidal effect of attraction and revolution. If now we start the earth rotating no more tides will be raised, because the force generated being centrifugal from the earth's centre is not tidal, and only creates a permanent bulge, or lengthening of diameters round the equatorial regions. Rotation has, however, a marked effect in multiplying the number of tides in a given time, by bringing the different meridians in turn into the already formed cones. The earth in fact rotates through the tide wave. i.e., through the ellipsoidal form taken by the ocean under the influence of the tide generating forces just described

These forces are all sufficient to account for tides on the ideal world of Laplace, and on our own globe where there is a free passage for the tidal wave, but the experts of the past were misled first by watching the tides of the English Channel (which are so anomalous that they come in from the westward instead of following the moon) where obstructions create rapid streams, and gave the idea that equilibrium could only be produced by surface currents. This again in turn led to mixing and confusing revolution with rotation, and thence to the dynamical theory, where the tidal wave being unable to keep pace with the moon drops back to quadrature. The wave was originally a free wave, whose speed is regulated by the depth of water. The ocean depths only permitting a speed of about 500 miles an hour, whilst the moon travels over the equatorial regions at double this velocity, the luminary outstripped the wave which then on dynamical principles became inverted. The forced oscillations of a pendulum are requisitioned to explain the inversion, but the analogy is hopelessly inadequate and misleading. The pendulum is inverted but the tide is only semi-inverted. If it were completely inverted the lunar and anti-lunar cones would exchange places, and nobody would be the wiser. But (except for the vertical rise and fall), we dispute that there is any analogy between the motion of a pendulum which swings to and fro, and that of the tide-wave, travelling continuously in one direction—more like the hand of a clock than the pendulum which works it.

I think that I have probably said enough to show both why the cones should be in conjunction (in line with the moon), and why they could not be in quadrature on the ideal world, but let us consider for a moment what the effect would be if they found themselves in that position, and what force would be available to keep them there, because whatever the position is, they must travel 1,000 miles an

hour in the equatorial regions, to keep pace with the moon as observation shows they do.

In dealing with the tidal force it is usual to resolve it into its two rectangular components, the one normal or perpendicular to the earth's surface, and the other at right angles to this or tangential. Now, it is quite obvious that at A there is no tangential component, and that the whole force is normal and acting outwards. As we move away from A the normal component decreases and the tangential infinitesimal at first grows till at a point nearer quadrature than conjunction it monopolizes the whole force. After that point is passed it decreases, and the normal component reappears increasing gradually, till it again represents the whole force in quadrature. Now, whilst its value and effect are not so obvious to the non-mathematical reader as in conjunction, it is easily demonstrated that in quadrature the tangential component is zero, and that the normal component acts inwards towards T, with exactly half the intensity it had at A. Thus the whole tidal force in quadrature is exerted to depress the water surface, and there is no tangential component to drag the wave crest along as required by the dynamical theory.

In my little book published last year, after showing how the tide-generating forces work, I described the principal interferences on our globe with the pure theory that would obtain on the ideal tidal world of Laplace, and showed how diurnal inequality was incompatible with the dynamical principles of that great mathematician, because if the tidal cones were in quadrature they must remain on the equator whether the moon is over it or the 29th parallel of latitude. The moon herself is a mute witness that nature forms the cones under the tide-producing luminary, the bulge in her equatorial regions, which before it solidified was a molten lava tide, being on the side next the earth that produced it.

Dealing as before with the lunar tides only, I will endeavour to picture the motion of the tidal cones as they would appear to an observer who could take up a sufficiently distant point of observation in the direction of the moon. If the moon remained over the equator, the tidal cone would travel round the ideal world beneath the observer with the crest mid-way between the poles. But the moon moves north and south of the equator like the sun, only much more rapidly than the latter, and instead of always just reaching the tropic she sometimes stops short at the 18th parallel before turning back towards the equator, and in other years attains the parallel of 29°.

If to-day the moon is over the equator, our observer in the heavens will see the summit of the tidal cones on the equator, but to-morrow it will have advanced 5° or 6° towards the pole, keeping pace with the moon. The next day the moon and the cone making a little less northing will be still farther from the equator and nearer the pole. and day by day as the earth rotates under the moon, the line joining the centres of the earth and moon passes through the apex of the tidal cone, which is farther from the equator and nearer the pole than the day before, although the rate at which it approaches the pole decreases. Our observer then from his post of vantage will see that the apex of the tidal cone describes a decreasing spiral from the equator towards the pole, and after about seven whorls, which it takes a week to complete, he will see the cone commence an increasing spiral towards the equator, which it will approach just as before it receded from it, the convolutions of the two spirals crossing one another as right and left-handed spiral springs would do if placed one inside the other. The cone having reached the equator, our observer would see a similar pair of spirals traced by it on the surface of the globe towards and from the other pole, all four being completed in a lunar month. The cone he has been watching is the apex of the lunar tide, which always faces the moon.

Diametrically through the earth on the side remote from the moon the anti-lunar cone travels round in exactly the same manner as the one I have described, the only difference being that it is slightly smaller because the overbalance of force is rather less there than on the side next the moon. These are the only two tides that the moon can and does raise, although variations in them are produced by changes of declination and distance of the moon, and the interferences already described in my book.

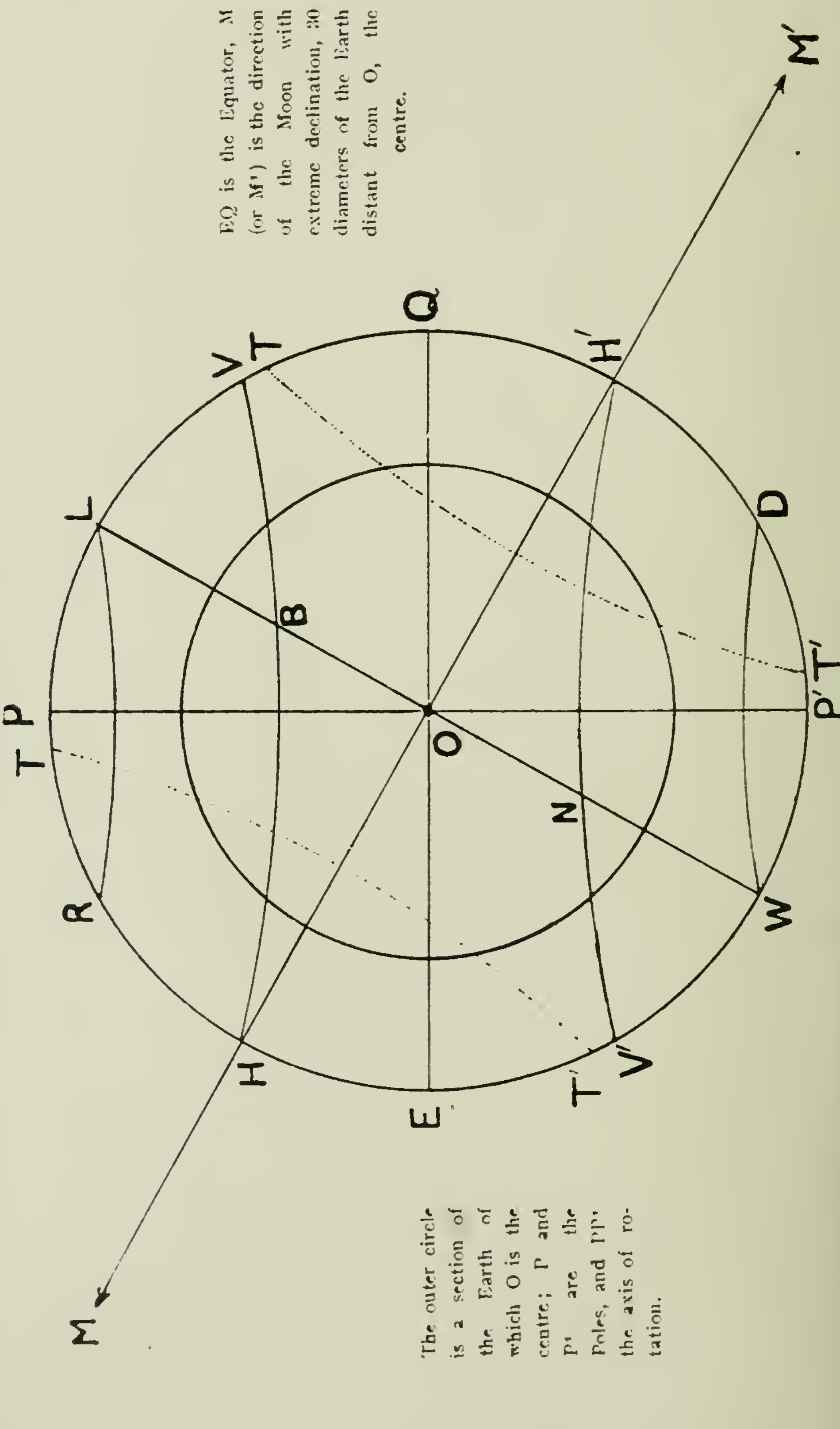
Midway between these two cones lies a belt of lowest water or greatest pressure, because there the moon's attraction is acting so as to assist terrestrial gravity in depressing the surface level. The variation in the heights of successive high waters is often spoken of as a diurnal tide, as if it was a separate entity instead of only a difference in two consecutive semi-diurnal tides. I will now explain a little more fully how diurnal difference, or inequality, is produced and give an example from actual observation, proving the accuracy of our views.

In the annexed figure let EQ be the earth's equator, PP' the axis of rotation, and HM the moon's direction. Then H will represent the apex of the lunar tide, and H' that of the anti-lunar tide, whilst WL will represent the middle of the band of depressed

water, any place situated on which will be in lowest water. At V and V^{I} there will be at the same moment a moderate high water, but not nearly so high a tide as at H and H^{I}, it being understood, too, that the tide at H^{I} will not be quite so high as that at H. As the earth rotates on PP^{I}, every place on the parallels HV and $H^{I}V^{I}$ will, during the lunar day, occupy successively the positions

DIAGRAM

To illustrate the action of Tide generating force of Moon on Ideal World; and as far as obstructions will permit on our Actual World. The Sun's force is similar but less.



The apices of the Tidal Cones are at H and H' and the parallels HV and H'V' rotate through them. The dotted circles are those of mean level 55° from H and H' and where the tidal force is wholly tangential. LW is the belt of lowest water. RL and WD are parallels of single day tides. If we remove the Moon from the plane of the paper and bring her vertically over O, the inner circle represents that of mean level, and the outer circle becomes that of lowest water, as WL was in the first case.—J.F.R.

with respect to the moon held in the diagram by H and H^1 respectively. When any place is at H or H^1 it is in highest water. When it is crossing WL, or the continuation of the hemi-circle LW on the side of the earth invisible in the diagram, it is in absolutely lowest water. When the place has rotated from H or H^1 to V or V^1, it will be in modified high water. It will thus, during the lunar day, have passed twice through low water, once through highest water, and once through the modified high water. For any place on the equator there will be no diurnal difference, except the very slight one owing to the high water at H^1 not being quite so high as that at H, and should the moon be over the equator, and so EH, or the moon's declination disappear, it is evident that diurnal inequality will practically vanish at all places.

The two semi-diurnal tides will be equal all over the world, or the difference will be so small (being merely that due to the tide opposite the moon through the centre of the earth being slightly less than that under the moon) that it may be neglected.

On the other hand, it is plain that while the moon's declination is as given in the diagram, the elevation of the water at H and V cannot be the same, nor can the elevation at V^1 be equal to that at H^1. It is also evident that, since the tide at H is higher than that at H^1, and consequently the tide at V^1 higher than that at V, the diurnal difference at H and V will be greater than that on the parallel H^1V^1, and thus it is plain that diurnal inequality is most marked when the latitude of the place on a true-tide bearing sea and the declination of the moon are of the same denomination

To make this clear, suppose the elevation above mean level at H to be 42 inches, then at H^1 it will be 38 inches. If, now, the rise at V^1 situated on the slope of the higher tidal crest is say 18 inches, that at V on the slant side of the smaller cone will be but 16 inches. The diurnal difference then on the parallel under the moon is 42—16=26 inches, or 30 per cent. greater than that in the other hemisphere due to the anti-lunar tide, which is 38—18 =20 inches.

This theoretic result was amply confirmed by the tides of Hobart, where, in 1893, Captain Goalen, R.N., found that the smaller of the two semi-diurnal tides disappeared when the moon had high southern declination. A fortnight later, when the moon had extreme northern declination, the same tide was very much reduced, but was still appreciable. The tide at Hobart is a small one. When declination is great and south, the lesser of the two daily tides fails to get up

the deep bay in which the port stands. Had it been nearer the open coast, the same difference would doubtless have resulted, but it might not so readily have caught the eye as the vanishing tide of Hobart, which is an exact corroboration of the principle I have just explained.

As diurnal inequality is thus dependent upon declination, it is clear that it will be greater at any given place during years when the moon reaches the parallel of 29°, than in others when she only moves 17° or 18° each side of the equator, and this has doubtless led to apparent inconsistencies.

Suppose, for instance, that a series of measurements of the tides were made in Sydney Harbour when the moon's declination reached 29°, and again a few years later, when it never exceeded 18°. The diurnal difference of the first set of observations would be much more marked than in the later survey, and if the cause of the discrepancy did not appear, it might be thought that one set was inaccurate. Again, should the measurements be made at Sydney during a period of maximum declination, and a similar set at another port about the same parallel and in the same ocean (say Parengarenga Harbour, New Zealand) during a period of minimum declination, a very different set of phenomena would be recorded in each case, and there would be a supposed inconsistency to unravel.

Dynamical theorists agree that diurnal inequality depends upon declination, but with the tidal cones in quadrature as they place them, they would remain constantly over the equator, and could, as I have shown, only produce the slightest inequality due to the difference in the height of the two cones.

Another interesting example of the influence of declination is given by a peculiarity of the tides of Hongkong, brought under our notice by a naval officer serving on that station. The " age of the tide " (the number of days after full and change of the highest tide) was there a variable quantity and upset all known rules, the highest spring tides occurring sometimes at full or change of the moon, and at other times as much as three days later. At Albany Island, in the same ocean, it was sometimes a minus quantity, the highest water preceding full or change by perhaps two or more days, and at other times following it.

These irregularities, inexplicable by the dynamical theory, are on our principles, necessary results of the tidal cone moving north and south with the moon. Hongkong lies between latitude 22° and 23° N. About the equinoxes the moon is full or new near the equator

three or four days later she is nearly over the parallel of Hongkong. For example, in April, 1898, full moon occurred on the 6th. The moon's declination on that day was 9° north. The apex of the tidal cone passed on 6th April over places 9° from the equator. On the next day declination was 5° greater and the cone 5° farther north, and so on to 9th April, when the moon was 23° from the equator, and Hongkong lay in the path of the very apex of the tide. The tide of the 9th was not so high under the moon as the tide of the 6th, when the apex of the time was nearly 1,000 miles away, whereas on the 9th it passed right over Hongkong, and so a delay of three days in the time of the highest water took place. The tide of Hongkong gained more from the approach of the apex of the tide than it lost by the decline of the tide towards neap. On 10th April the moon was still farther north, and Hongkong lay to the south of the tidal summit. The decline towards neap was then assisted by the change in the distance of the highest point, and the tide did not rise to the level of the day before.

Had the moon been over Hongkong when she was full and moving south, the highest tide would have occurred on that day. †In June of this present year it will be full moon on the 4th, and new moon on the 18th in Eastern waters. At full moon the anti-lunar tidal cone will be nearly over Hongkong, as will be also the solar tidal cone. As, however, the latter is nearly stationary in latitude, and the former is moving slowly north, and passes over it again about three days later on its way south, whilst the moon is all the time getting nearer the earth, the highest of three or four high tides will probably be two or three days after full.

At new moon on the 18th the tide will be higher than on subsequent days because, though the moon is moving north, and has to come back over Hongkong, she will lose more by her separation in longitude from the sun and by reason of increasing her distance from the earth, than she will gain by her own verticality.

Under the head of apogee and perigee, the moon's greatest and least distances from the earth are recorded in most almanacs, as well as her declination (corresponding to latitude on the earth) and the hour of her meridian passage. If the moon is within a day of two of perigee at full or change, the decrease in her distance in the next 24 or 48 hours may have as great an effect in keeping up the height of the tidal cone under the moon as the sun's separation from her has in lowering it.

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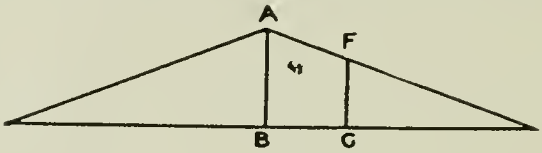
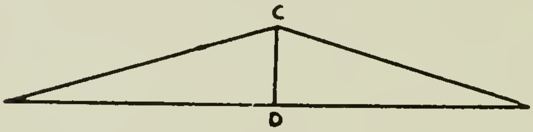
† Written in March.

If in the diagram the upper cone with the greater altitude represents the crest of the lunar tide at full or change, the second cone with a lesser altitude may be taken as representing the same tide two or three days earlier or later, when the apex will be lower,





because the sun's influence is oblique to that of the moon. Now, whilst AB is, of course, greater than CD, it is equally evident that CD is greater than FG, which may be taken to represent the height over Hongkong on 6th April. Three days later CD would be over Hongkong and produce a higher tide there than when AB measured the rise 1,000 miles farther south.

The same diagram will do to illustrate the tide at Albany Island, CD representing the apex right over the island two or three days before full moon, and A the summit of the cone on the day of full moon 800 miles farther south, whilst the island on the slant side of the cone will only have an elevation FG above mean level.

Albany Island is in latitude 11° S. On 4th June this year, when the moon will be full, she will be over the twenty-third parallel of south latitude. On 1st June she will be over the twelfth parallel and so Albany Island will be in the apex of the lunar tide, and will have a higher tide than when the moon is full and crosses that meridian twelve degrees farther south. The tide is, of course, higher under the moon on the 4th, but on that day Albany Island is 800 miles distant along the slope of its northern shoulder.

Dynamical theorists used to tell us that just as the weather in England is warmer in July than in June, when we have longer days, and the sun higher in the heavens, so the oscillations of the tide go on increasing after full moon and produce the highest tides a day or two later. It is obvious that this explanation is worse than useless in the case of Albany Island, and not because the tide is anomalous, but because it obeys a simple and natural law. An explanation which nature so emphatically contradicts in the case I have just quoted, is hardly likely to have any value even in more plausible instances. At Albany Island the result of observation and enquiry supports our theoretical conclusion that the only oscillations in the tidal problem

are the vertical rise and fall of water and the swing of the cones north and south of the equator.

This vertical oscillation is the essential characteristic of wave motion, which distinguishes it absolutely from current, and is the only conceivable explanation that makes it possible to combine the enormous velocity entailed with immunity from destruction to everything in the path of the wave.

The tidal wave travels round the equatorial regions at over 1,000 miles an hour. A current with only a fraction of this velocity would sweep everything before it. The dynamical theorists talk of the moon dragging the tidal wave round 90° behind her, where the dragging or tangential force is admitted by all to be zero. The expression is a most misleading one, implying horizontal transference of the water, whereas in wave motion it is the form alone that travels along horizontally, the change in position of the crest being brought about by vertical oscillations of the particles of water. The protuberance rises to form the cone at any particular spot on the earth's surface, because the moon is vertically over it, and terrestrial gravity is most counteracted there. The next moment the protuberance is at the next spot, not because the water previously raised has been dragged forward, but because the former protuberance is sinking and a new one rising.

As the moon moves from east to west, the particles in front of her are always rising vertically in response to her increased attraction; and those to the eastward of her, which she has passed over, sinking vertically because she no longer attracts them so forcibly. At each instant a new set of particles receives the strongest pull of the moon's attraction, and the same applies on the other side of the earth to the particles acted on by the overbalance of centrifugal force. Whilst the wave form thus moves from east to west, there is no horizontal translation of particles of water. To a distant observer, if he could mark the progress of the cone, it might appear that the water was being transferred laterally, but it would be a mere optical illusion, which would be dispelled if he saw the wave meet a floating object, such as a log or a boat. The wave travelling with enormous velocity would leave the boat where it found it. A current, on the other hand (as in a river), would carry the boat with it. Treating the tidal protuberance as a wave moving like a current has been the cause of much misconception in tidal theory.

Another anomaly that were asked to explain was why the tide at Whampoa dock was 4 feet higher in June than in March., when theory taught us to look for the highest tides at the equinoxes. Such it is true, is the teaching of the dynamical school, which we cannot

subscribe to. We hold, on the contrary, that on an ideal world the tidal cones would always be under and opposite the moon (neglecting for simplicity all consideration of the solar tide), and that on our actual world the same holds good as far as obstructions and interferences permit. Consequently, equinoctial tides are only greatest in the neighbourhood of the equator, and Whampoa dock, being near the tropic of Cancer, will have its greatest tides when the moon is at her nearest to that parallel, and almost as large ones when near Capricorn she produces the anti-lunar cone close to the northern tropic. At the solstices she will have the solar tide cones close to her own, or possibly coincident with them, and very high tides must result with large diurnal inequality.

Whilst to avoid complication and simplify the problem for the general reader, I have left the solar tides out of consideration, they are formed by the sun in exactly the same manner as the lunar cones are produced by the moon, the only difference being that they are smaller, because while the sun's attraction is enormously greater than the moon's, the overbalances of force, which are the actual tide raisers are much smaller, owing to the sun being four hundred times more distant than our satellite. When the sun, earth, and moon are all in a line, as during an eclipse, the lunar and solar cones are superimposed one upon the other, and *cæteris paribus* produce maximum tides. When the moon is on her first and third quarters, her tidal cones are on a diameter of the earth at right angles to those of the sun, and each pair of cones subtracts from the height of the other, producing neap tides. On other days the height of the tide has an intermediate value, depending on the inclination of the axis of the solar to that of the lunar cones, or approximately on the difference of meridian passage of the tide-producing bodies.

The researches and measurements of Professor Hecker, of Potsdam Observatory, are the strongest confirmation of our theory. The earth tide which he has succeeded in measuring is an equilibrium tide. It must be formed by the differential pressure of gravity caused by the overbalances of centripetal and centrifugal forces. The description of wave motion in the ocean applies equally to it, the particles taking a little over six hours to attain their greatest elevation of about 8 inches, and the same time to sink to the level from which they rose.

That the tide-generating forces should produce dynamical tides in the ocean, and equilibrium tides on dry land, is as inconceivable as that these latter could be formed by surface currents, and so assurance has been made doubly sure.

TIDES II.

Two thirds of a century ago, the most authoritative treatise on tides was probably that in the Encyclopœdia Metropolitana, by Sir George Airy, a highly distinguished mathematician, and then Astronomer Royal. Whilst he admitted that the Equilibrium Theory had its uses, he condemned it unsparingly as an explanation of tidal phenomena. I have already shown strong reasons to doubt his conclusions, and will now by further quotations endeavour to make it clear that he misinterpreted the theory he judged so uncompromisingly, and misread the face of Nature. He says, " Suppose now, that the water assumed the form which we have found, and that the earth revolves within its coating of water. This supposition, absurd as it is, is the only one upon which it is possible to apply the Equilibrium Theory." If this was the interpretation of the Equilibrium Theory by the greatest expert of his day, it probably was that of his predecessors and it was fifty years later, when Moxley first pointed out that the supposition formed no part of the theory, and was on the contrary, in direct opposition to it. The Equilibrium Theory does not postulate an earth, whose solid nucleus revolves within a coating of water, through which the protruding continents sweep at the rate of 1,000 miles an hour. It postulates an earth rotating with its coating of water through an ellipsoid form. The ellipsoid is formed by the coating of water itself, the water actually composing the protuberance changing from moment to moment, and therefore not remaining with the moon to be swept through by protruding continents and islands, but sweeping forward with the earth's rotation in company with the continents and islands. It is a state, and not a body that remains with the moon by the Equilibrium Theory ; it is a form (or shape), and not a material that is permanent, whereas the statement of the astronomer is, that it is the water which at any moment forms the protuberant or ellipsoid form that remains, the solid earth rotating through it. That this fallacy in a standard treatise escaped detection for half a century is sufficient to show how universally it was believed and accepted, and how little chance the Equilibrium Theory had of establishing its claims with the scientific world. Now, the misconception is universally admitted, but full recognition is not yet accorded to the consequences of the discovery, because the dynamical Professors are loth to surrender all belief in the theory they have accepted so long, notwithstanding their own admission of its shortcomings. Sir George Airy acknowledged its complete failure to explain diurnal inequality in the Pacific Ocean, " where the case possesses considerable analogy to his (Laplace's) assumption," i.e., a sea of equable depth with no land to interfere with the progress of the tidal wave.

Inimical as the supposition I have just dealt with, has been to the theory I am advocating, I subsequently discovered in the same treatise, a statement that I believe is equally fallacious, and that is fundamental to the dynamical theory. After stating that the theory of Laplace is one of motion, he continues, " A small vertical rise implies large horizontal motion. Suppose in one part (quadrant) the length of the canal is 1,000 times the depth, and suppose the water depressed one foot. It is evident that the volume of water (omitting factor of breadth) for which a new place has to be found is = length of canal × 1 foot = 1,000 × depth × 1 foot, or depth of canal × 1,000 feet. Consequently, the water at one end, if that at the other remained unmoved horizontally, must have moved 1,000 feet, or 1,000 times the vertical movement."

I do not think that this statement or conclusion bears any resemblance to the unobstructed tidal movement of the water on the earth's surface, which I will now endeavour to illustrate, even though my analogy be not quite perfect.

Imagine a tube of uniform bore, 6,000 miles long round a quarter of the earth's equator, with each end turned up to a height of 8 feet. Let it be filled with water which stands 4 feet high in each end of the tube. If now, we insert a piston at one end, and force it down to within a foot of the bottom of the tube, the water surface will be depressed 3 feet, and in the other end of the tube it will have risen 3 feet. It is quite obvious that in the horizontal portion of the tube, the amount of movement has been the same. Every particle of water in the tube will have moved through the same distance, and the horizontal movement has not exceeded the vertical movement. If we increase the number of tubes sufficiently, we have an approximation to the action of the tidal force, the principal difference being that in the tubes the pressure is uniform, and the motion wholly tangential (except of course in the ends), whilst in the case of the tide generating force, the pressure is differential over the spherical surface. This supposed necessity for comparatively enormous horizontal motion, associated with a few feet of vertical rise and fall, seems to have been the assumption which misled Laplace, and stultified in a large measure the result of his investigation. The name of Laplace is one to conjure with in the mathematical world, but the greater his ability, and the sounder his reasoning, the more certain he would be to come to an erroneous conclusion if he started with false premises, as I assume he did from Airy's account of his theory, which still receives official recognition.

The dynamical theory of the tide dies hard, notwithstanding its admitted failure to explain the movement of the waters on the

surface of our sphere and that it covers the globe with anomalies, but I think that the recent discoveries and measurements of Professor Hecker, of Potsdam Observatory, have at last given it the "coup de grace."

Founded originally upon the same fallacy that displaced its predecessor and which assumed that equilibrium could only be produced by surface currents for whose effective action nature refused to provide sufficient time, it has been bolstered up ever since by other fallacies, the help of Newton's theory, and the analysis of actual tides. The impossible currents from east and west and from north and south were still retained, connected in some mysterious way with the dynamical wave, which by the principle of forced vibrations should be inverted, and yet is only semi-inverted to quadrature. In this position the non-existent tangential component of the tide generating force drags the wave round after the moon. We would then have the lunar tidal cones always on the equator, where they could produce no diurnal inequality (except the minute difference due to parallax), and on a diameter of the earth's perpendicular to the moon's direction, instead of as in the equilibrium theory at the extremities of the diameter which points to the moon.

Such, briefly, is the dynamical theory of Laplace, which supplanted the equilibrium theory of the greatest natural philosopher that the world has ever seen, when the latter, and after him Daniel Bernouilli, had altered it to produce results more in accordance with the only tides they had to compare it with, those of the English Channel. Now for hours before the moon reaches the meridian in this locality she has been passing over dry land, where although producing the earth tides measured by the German savant, it would indeed be astonishing if she could bring the ocean water with her to form regular tides along the coasts of Western Europe, as she would do on the ideal world (one covered completely with water) and actually does in the Southern Ocean.

The apices of the equilibrium cones are under the moon, and diametrically through the earth on the side remote from her. The water is raised under the moon because there she produces her greatest effect in counteracting the earth's gravity, which attracts every particle on the surface of our globe equally towards the centre (assuming the earth to be a sphere). If we imagine a series of circles to be drawn round the apex of the cone similar to parallels of latitude round the pole, every point in any one circle will be the same distance from the moon, but each circle as we leave the apex will be farther from her, and attraction on the particles composing it will decrease in

the ratio of the inverse square of the moon's distance. This gradual decrease in the moon's attraction or centripetal force is equivalent to an increase in the pressure of terrestrial gravity, and is the cause of the formation and maintenance of the cone under the moon.

The centrifugal force developed by the earth in its revolution with the moon round their common centre of gravity counteracts the centripetal force, and keeps them from approaching each other. Whilst it is obvious that the two forces must be equal on the whole and on the average, centrifugal force, unlike the other, is the same for every particle in the earth. Consequently, while near the earth's centre they exactly balance each other, it is clear that on the side next the moon centripetal force must be stronger, and on the remote side weaker, than centrifugal force. The excess of force on each side, the "overbalances," as they are called, create the tidal cones, one, as I have already described it, towards the moon, and the other in an exactly similar manner away from her on the opposite side of the earth, the only difference being that the latter is slightly smaller owing to decreased parallax. If the earth were non-rotating these cones, which are at the extremities of the major axis of the ellipsoid of revolution, would travel round with the moon, producing only two tides in a lunation. The moon forms the ellipsoid by causing differential pressure on the watery coating surrounding the ideal world, the particles forming the protuberances changing from moment to moment so as to keep the major axis pointing to our satellite. The only deviation from permanency is caused by variation in her distance. Rotation raises no tide, although it creates a protuberance that lengthens the equatorial diameters and makes no difference in level along any particular parallel of latitude; but as the earth rotates through the ellipsoid the number of tides are multiplied by the frequency with which each meridian is brought under the already formed cones.

Unlike the currents of the dynamical school, which require indefinite time, the pressure I have described can act as instantaneously as atmospheric pressure in the cistern of a barometer, or on the surface of the ocean itself, when it reduces the height of the tide.

More than one of our critics have asserted that they do not understand our claim that Moxly was the first to suggest pressure instead of current, and that mathematicians have always been accustomed to work with pressure when discussing hydrostatical and hydrodynamical problems. I think it will probably be a sufficient, although by no means the only, refutation I could advance of this statement if I refer the reader to the work entitled, "Tides

and Kindred Phenomena," by the greatest dynamical expert of the day, and published since this controversy commenced. In it he will seek in vain for any suggestion of pressure. He will read that equilibrium could only be produced by currents flowing "down hill," till counteracted by a tendency to flow "up hill," and that "with the earth spinning at its actual rate, and the moon revolving as in nature, the form of equilibrium can never be attained by the ocean." This was why the equilibrium was abandoned for the dynamical theory, but any allusion to pressure is still conspicuous by its absence, and currents from every point of the compass flow to and fro and oscillate to form the dynamical wave, creating eddies and vortices (p. 159-161).

Now the same forces are operating to form the earth waves measured by Professor Hecker, but he measured no surface currents and observed no vortices. The tides he noted are obviously due to pressure.

I have shown elsewhere (Moxly's Theory of the Tides) that the description given of the dynamical theory in "Tides and Kindred Phenomena" does not agree with that put forward a few years earlier by another professor in "Time and Tide," whilst neither is in accordance with a third interpretation sent to Moxly a couple of years ago by a professor of his own University to combat our views. In it the centrifugal force of revolution without which the earth and moon would inevitably collide, and which is the cause of the anti-lunar tide, is omitted altogether, and whilst pressure is mentioned in a way that we doubt would be effective in tide raising, it certainly is not introduced as the prime cause of tides on our world, and the only cause of them on the ideal world of Laplace, with every obstruction, such even as wind removed. Pressure may have been (and probably was) Newton's original conception of tide generation before he was misled by the tidal streams of the Channel, but it was not thus that he gave his theory to the world, nor has any writer on the tides before Moxly suggested it.

It is true that of comparatively recent years pressure seems to have been associated with the idea of tides in the solid crust of the earth, and with the figure of the earth itself, and so it is all the more extraordinary that when the dynamical theory proved so unsatisfactory none of the experts should have thought of applying the same principles to the tides of the sea. Some thirty years ago, the late Lord Kelvin, for whose scientific ability and inventive genius, I in common with all navigators, have the greatest admiration and respect, predicted these earth tides and the effect of the moon's

attraction on the shape of the earth. He demolished the argument of some geologists that the earth was hollow and filled with molten lava by showing that even if the crust was 50 miles thick it would have to be scores of times more rigid than steel not to take the equilibrium form, i.e., the earth and water would yield to the tidal influence, together as a whole, and there would be no relative displacement of the water to give us the phenomena of tides. He estimated that the rigidity of the earth was probably the same as that of a solid globe of steel when it would still yield sufficiently to reduce the ocean tides to only two-thirds of what they would be if the earth was perfectly rigid.

I understand that Hecker's measurements confirm the accuracy of this estimate, and the foresight of its author. Kelvin, on whose shoulders descended the mantle of Newton, was, however, a very busy man, and had not time to go to the root of every subject himself, and so probably owing to the pressure of other work, he did not question the conclusions of his great predecessor, Laplace, which he used as the basis of his speculations on the tidal problem of the ocean.

I have been told by a very clever mathematician that the equilibrium theory of Sir Isaac Newton and the dynamical theory of Laplace " refer to ideal tidal problems, neither of which can be applied to the actual circumstances of our globe." I was of course, aware of the first half of this statement, and think that the second portion requires considerable qualification. Each theory was in turn evolved for an ideal globe as a stepping stone towards understanding the action and result of the tide generating forces on the world in which we live. If we form an erroneous estimate of the action of the tide generating forces on the ideal world (one completely covered with water of a uniform depth), this must inevitably mislead when the tidal expert endeavours to combine it with the probable effect of obstructions on our globe, and may make these latter appear to act in a manner exactly the reverse of reality. On the other hand, if we know certainly how the tide raising forces would play their parts on the ideal world and can form a fairly accurate idea of the effects of obstructions in the shape of land and shallowing sea floors on our actual world, we can combine the two to make very close predictions; or if the effect of obstructions is the unknown quantity, we ought to be able to get somewhere near it by comparing actual tides with the theoretical ones.

Let us consider for a moment an intermediate condition, and assume that all the land on the surface of the globe has been removed

except the island continent of Australia, and that the remainder of the earth is covered with water to the most suitable depth for the dynamical wave. Suppose the moon with 25 deg. southern declination to be over the east coast of Australia. It will take about three hours to reach the west coast, and she will pass over the centre of the continent. Vertically under her during the whole of this time the land will attain its greatest elevation, the particles rising slowly as she approaches them and sinking similarly after she has passed. Now, is it reasonable to suppose that while the moon is elevating the land under her, she is by no means of a totally different process raising the water of the ocean on the meridian 90 degrees, or six hours to the eastward, and the same to the westward ? If so, when she had travelled another three hours to the westward her tidal force would be acting vertically downwards with maximum depressing effect on the east coast of Australia while piling up the water of the adjacent ocean to its greatest tidal elevation. I do not think it can be necessary to employ the higher mathematics to prove the absurdity of such a supposition.

But it is not only to the vertical movement of the solid earth, that I can appeal for support of our views, because they are also corroborated by the atmospheric tides. Between the years 1840 and 1844 a long series of observations in the island of St. Helena by Captain Lefroy, R.A., and Captain Smythe, R.A., demonstrated conclusively that there was an atmospheric tide, with the crest under the moon, and this was confirmed by subsequent observations during the two following years, which were examined and verified by Colonel Sabine, and analysis showed that it was the greater at perigee than at apogee, as, of course, it should be theoretically. The height of the tide on the ideal world, for an ocean five miles deep, has, I believe, been calculated by experts to be between three and four feet. Taking it as $3\frac{1}{2}$ ft., the height and mass of the water raised will be to the depth and mass of the water below it as 42 inches are to five miles. That is, the weight of water raised will be, to that below it, as 1 is to 7,543. If now, we take the average weight of the atmosphere, as measured by the barometer, to be equal to $29\frac{1}{2}$ ins. of mercury, the weight of the aerial wave can be obtained by simple proportion : as $7{,}543 : 1 :: 29\frac{1}{2}$: weight of the elevated cone of air =.00391 in. Whilst this is but a rough approximation, it is probably not very far out, and is given to show that the tide found by Captain Lefroy, which was only .0039 in., is sufficient to establish beyond doubt the fact that there are vertical oscillations in the atmosphere similar to those which affect the water of the ocean. Where the producing cause is the same, and the magnitudes proportional, it is surely highly improbable that there will be any material difference in the position

of the tidal crests. In this case the atmosphere yields more easily than the ocean, but, on the other hand, the earth is more rigid, and yet we find the same result. The author of "Tides and Kindred Phenomena," tells us that both the equilibrium and the dynamical theories "must be abandoned as satisfactory explanations of the true conditions of affairs." With that statement I am in fullest accord if (as no doubt he does) he means the equilibrium theory, as interpreted by himself, Sir George Airy, etc. Putting current in the place of pressure, and confusing it with wave motion, substituting rotation for revolution, and treating them as if they were synonymous, rendered Newton's theory abortive from the first, and would have destroyed the dynamical theory even if its conception had been sound.

The new theory, where the same pressure that Lord Kelvin showed would, if the earth were hollow, keep it in a continual state of hydrostatic equilibrium, and that raises earth tides and atmospheric tides under the moon, is the prime source of tide generation, would explain everything on the ideal world, and removes at first sight the great bulk of the so-called anomalies on our globe, and will probably account for the remainder, when the special conditions in each case can be studied closely enough to account for the effect of local obstructions. In "Moxly's Theory of the Tides," I have proved this by numerous examples, and shown that diurnal inequality is absolutely incompatible with the dynamical theory, and can only be explained by an equilibrium diagram, which the orthodox tidal experts use, although, according to their teaching, it represents nothing in Nature.

In a previous paper written for the Royal Geographical Society, I gave a more detailed account of diurnal inequality with many illustrations of tides conforming to our theory that were previously inexplicable. These are now sufficiently numerous to preclude the possibility of mere coincidence, and are moreover so simple and obviously correct when the true theory is once grasped, as to leave no doubt in any unprejudiced mind. I will, however, give a few more examples.

The Tide Tables for the Coast of California, and the Admiralty Tide Tables insert this note, viz., "The tides on these coasts are of so complicated a character, that the following general explanation is considered necessary:—There are generally in each 24 hours, or rather lunar day of 24 hours 50 minutes, two high and two low waters, which are unequal in height, and in time, in proportion to the moon's declination, differing most from each other when the moon's declination is greatest, and least when the moon is near the equator.

The high and low waters generally follow each other thus. Starting from the lowest low water, the tide rises to the lower of the two high waters (sometimes improperly called half-tide), then falls slightly to a low water (which is sometimes merely indicated by a long stand), then rises to the highest high water, whence it falls again to the lowest low water."

The reason of this sequence is readily understood on our principles, by referring to a map or chart of the world, or the annexed diagram, in which HV represents a parallel of latitude passing through the region of these complicated tides. (See Diagram on page 8.)

Leaving the sun out for the present, and remembering that his influence will, as his declination increases, accentuate the pecularities noted. Let us assume the moon to have extreme northern declination, and that H^1HM represents her direction. PP^1 is the earth's axis of rotation, EQ the equator, and LW the circle of greatest depression. The Pacific Ocean has here a breadth of 120° of longitude; the remaining 240° may be treated as land, the Atlantic, having as far as these tides are concerned, no influence whatever. Starting, as the note does, with the coast line of California, in its lowest water, we shall find it at B, the intersection of HV and WL; before it (eastward) 240° of land, behind it (westward) 120° of water. When the point we are considering, on the Californian coast is in lowest water, the apex of the tidal cone would be on the ideal world at H, where on our earth are the eastern coast of Asia. Thus, there will be an expanse of open water all along the parallel from H to B. The differential attraction of the moon will therefore have its full force in producing a depression at B, and the water will be the lowest possible. As the point treated of rotates towards V, it passes into the region of high water, but as V is some 57° from the highest water at H^1, the high water there (at V) will be but relative, and actually below mean level. Our point is at what the note states is improperly called "half tide." As the point rotates further, it comes into the region of lowest water. But mark the difference! When last in lowest water it had continuous sea between it and the point under the moon. The water was then under the full squeeze of the pressure of gravity, or in popular language it was being drawn with the full attraction towards the moon. But now between it and the moon lies a region of solid land (America). There is no pressure towards the moon at the moment it is crossing the continuation of WL (back of the diagram). True there is a pressure towards V, but as I have already shown the high water at V, is below mean level, and therefore, in the progress of our point on the Californian coast from V to low water

there is but very little increase of pressure, and the water "falls slightly to a low water, which is sometimes merely indicated by a long stand!" The moon's influence alone permits a slight fall. When the sun has high declination, and his influence is added to the moon's there is no fall—only a long stand.

Thus we see that these abnormal tides of California are but an instance of strictest obedience to law. Every phase of the tidal movement, even the slightest variations of rise and fall, are just what might have been expected. Doubtless, if the earth were completely covered with water, there would be no such peculiar tides, but as this is not the case, the configuration of solid land causes complications of tidal movements, yet never takes them out of the kingdom of natural law.

Now, notice the remarkable contrast between the order of succession of high and low waters in the extract from the Admiralty Tide Tables quoted above, and the following note from the same publication, referring to the East Coast of Australia. "From April to October the night tides are higher than the day tides, and the reverse for the rest of the year. The usual sequence of the tides is from the lower low water to the higher high water." I have shown elsewhere the reason for the first half of this note, and that unless delayed by shallowing sea floors, and abnormal retardation day tides are always higher in the summer, and night tides in winter. But the second sentence? On the west coast of California, the sequence is from lowest low water to lower high water, and on the East Coast of Australia from lower low water to higher high water. And the reason? When the East Coast of Australia is passing the point N in the diagram, it is in the region of lowest water, and there is a clear stretch of sea between it and the summit of the tidal cone at H^1, and nothing to obstruct or interfere with the fall of the water. The locality then moves on to H^1, into highest water, and then again to the region of low water at the back of N. But now the continent of Australia is behind it. There is no pull or pressure of the water to H^1, because land is in the way, but only to the modified high water at V^1. This low water will, therefore, not be so low as the previous low water. The succession will then be as stated in the tables, and the difference in order of succession from that on the Californian Coast seen to be a necessity. It is quite impossible to explain either of these sequences by the dynamical theory, nor has any dynamical theorist ever given any explanation of them.

The diagram will also serve to illustrate the single day tides, which are simply cases of extreme diurnal inequality in the very

place where, according to Laplace, it ought not to occur. The Tide Tables have the following note about the tides of British Columbia: "The diurnal inequality is great, causing apparently but one tide in the 24 hours on many days." Not a hint is given here, or in the dynamical text books as to the cause, although it has been noticed by some observers and theorists that the phenomenon is coincident with high lunar declinations. By the dynamical theory these tides are simply "anomalous."

They cannot occur when the moon is over or near the equator but when she has high declination, as in the diagram, it is quite obvious that there can be but one high or one low water in the lunar day, for a place situated on either of the parallels RL or WD. When the place is at L it will be in lowest water ; in half a lunar day it will have rotated to R, and have the highest water possible on that parallel, on the slope of the cone of which H is the summit. Twelve hours and twenty-five minutes later it will be back at L. These tides are a sheer necessity of our theory, and would be regular and well marked on the ideal world, and most noticeable and perfectly formed on the parallel of latitude, which is the same number of degrees from the pole, as the moon is from the equator. Being so far from the apex of the cone, the rise is small, and thus easily disguised, or interfered with by land configuration on our globe. They could be observed best on a small island south of the 60th parallel of south latitude, especially if the island had a long stretch of open ocean to the eastward of it. The conditions would then approximate to those on the ideal world.

TIDES OF FREMANTLE.

By CAPT. J. F. RUTHVEN, R.N.R., F.R.G.S, Hon. Corr. Mem., R.G.S.A.Q.

Until quite recently, there have been no attempts to compute or publish locally any Tide Tables for the ports of Western Australia. When, however, Fremantle and the adjacent coasts were surveyed by Staff Commander Archdeacon, R.N., in 1873-4, the tidal observations taken were submitted to a searching analysis by the Hydrographic Office of the Admiralty, assisted by the ablest dynamical experts of the day. The results, according to one of the greatest living mathematicians "disclosed very remarkable complications," and were admittedly inexplicable by the received theory of the world (Laplace's), which was the only criterion they were tested by.

Owing to its geographical position, the tides of Fremantle will be largely affected by retardation; and observation shows that wind and barometric pressure have a very marked influence on them. Subject to these interferences they will conform to the new equilibrium theory.

The moon's tidal influence is greatest in perigee when she is nearest the earth, and least in apogee the most distant point in her orbit.

SOLSTITIAL SPRINGS.

The maximum rise and fall, and greatest diurnal inequality will take place at Solstitial Springs when the moon, as well as the sun has highest Southern declination coincident with perigee. This case is represented in the preceding diagram (illustrating "Tides"), if we suppose the moon to be in the direction of M^1, when for practical purposes we may assume the sun at new moon to be in the same direction, and to avoid complicating the figure that the parallel H^1 V^1 passes over Fremantle, which is actually only 3° South of it. Then the combined cone due to sun and moon will pass almost vertically over Fremantle

in the day time, and give it the highest possible water there (at H^1). As rotation carries the port behind the diagram past the circle of mean level, and then of lowest water to V^1, there will be another high water (night tide), but it will be so small as to be actually below mean level. There will then be a slight fall to where the parallel crosses WL, followed by a long flood to highest water again at H^1. This second low water will not be so low as the previous one, because the continent of Australia interferes with the free action of the moon.

If the moon's declination is exactly equal to the sun's ($23\frac{1}{2}°$), the superimposed cones with maximum elevation would pass only 500 miles north of Fremantle, and give it nearly as high a tide as in the former case. The night tide at V^1 would then coincide with the end of the dotted circle indicating mean level, and diurnal inequality, though still large, would be reduced. This dotted circle is 55° or 3,300 miles from the apex of the cone.

If the moon was full in the direction M, the water would not rise quite so high, nor fall quite so low as when the sun and moon were both over the Southern Hemisphere, and diurnal inequality would be less.

SOLSTITIAL NEAPS.

A week later the Moon will be over the equator whilst the Sun has moved less than 3° towards it and their times of crossing the meridian will differ by about 6 hours. When the Moon is over Q (in the direction EQ produced) and Fremantle near H^1, she is doing her utmost under the circumstances to raise the level there, but the apex of the cone is 1900 miles north of the port, whilst the circle of mean level is only 1400 miles south of it. Consequently her tide more than half way down the slant side of the cone will be very much smaller than when she crossed the meridian within a few degrees of the port. At the same time, the sun six hours to the westward on the meridian through P and P^1 perpendicular to the paper, and 20° south of the point over O, is trying to produce low water at H^1, and still further reduce the comparatively small high water caused by the moon. As rotation carries our port to V^1, it will again find itself in high water under almost identically the same circumstances as twelve hours before. It will be practically the same distance from the anti-lunar cone as it was from the lunar cone at H^1, and the sun will be relatively in very much the same position. The two principal lunar tides will thus be practically alike, and there will be no diurnal difference, except the almost infinitesimal amount due to parallax. It is true that the sun will theoretically produce some inequality, but owing to his great distance

it is so small that it may be neglected. The lower low water will be, however, when the moon is to the westward, exerting her influence over the open sea.

Thus, whilst there is at Solstices a great difference between the range and diurnal inequality at Springs and Neaps, I will now show reason why a very different set of phenomena will be observed at the equinoxes.

EQUINOCTIAL SPRINGS.

At this season, if both luminaries are over the equator in the direction E Q produced, their joint cone will be a large one, especially if the moon be in perigee ; but the apex is 32° from Fremantle, whilst the circle of mean level is but 23° further south. Consequently, the rise will be barely half what it is under the moon, and there will be no diurnal inequality, except that due to parallax ; i.e., to the cone on the opposite side of the earth being slightly smaller than that under the moon.

EQUINOCTIAL NEAPS.

A week later the moon will be near the latitude of Fremantle ; in years of great declination within 3° or 180 miles. If in addition she happens to be in perigee, Fremantle will be very near the apex of a large lunar tidal cone, from which the sun, still near the equator, and six hours to the westward, will subtract something. As the Solar tide is, however, so much smaller than the Lunar, the rise may equal, or even exceed that at the spring tide a week before, especially if the moon was then (at the earlier period) approaching the earth.

As Fremantle rotates towards the circle of lowest water, the sun's influence, acting against the moon's, will keep the water from falling as low as it otherwise would, and it will rise again to high water at V^1, which will probably be below mean level, and so there will be large diurnal inequality at equinoctial neaps. From V^1 to the intersection of the parallel with L W, there will be a slight fall, opposed by the sun's action, and interfered with by the Continent of Australia, lying between the apex of the lunar cone and Fremantle. This will be followed by a long flood to H^1, which the sun's influence will detract from to a very moderate extent.

The Solstitial tides I have described, are those pertaining to the Southern Summer, when day tides have the greater rise, and new moon produces the greatest diurnal inequality. At the Winter Solstice night tides will be the greatest, and full moon account of the largest diurnal difference, and this because the lunar cone is larger than the anti-lunar, whilst owing to the sun's great distance the Solar cones are practically identical.

A strong N.W. wind not only drives the surface water from the Indian Ocean on to the land, but also banks up the water from Cape Leeuwin, brought by the tide wave along the South Coast. The low barometer accompanying the wind, indicating decreased surface pressure, helps to raise the level.

So much for theory, which I would not set much value upon, unless supported by observation. The Chief Harbour Master, Captain Irvine, informs me, that whilst in fine weather, with a steady barometer the tides succeed each other with great regularity, a gale or series of gales upsets them altogether ; and during the continuance of the bad weather neither heights nor times can be depended upon. When the weather settles down the tides resume the regular sequence which the new equilibrium theory predicts, and thus another set of anomalies can be expunged from the Tide Tables and Text Books.

THE STORY OF THE FALKLAND ISLANDS.*

By HIS EXCELLENCY, HON. W. L. ALLARDYCE, C.M.G.
Hon. Corr. Mem., R.G.S.A.Q.

It has been alleged by some writers that the Portuguese navigator, Americus Vespucius, saw the Falkland Islands in 1502, but if the account given by Vespucius of his own voyage is correct, he never came further south than the La Plata River in Argentina.

Other writers maintain, and these are mostly Spaniards, that the great discoverer, Magellan, must have seen these Islands, but Magellan, during his voyage round the world in 1519 and 1520, makes no mention of having seen the Group, and it is reasonable, therefore, to suppose that he did not see the Falklands.

There is, however, considerable evidence to shew that a few years after this the Falkland Islands were discovered by some unknown foreign navigator. On two charts which were constructed for Charles V. of Spain, one (anonymous) in 1527, and the other by Diego Ribero in 1529, they are shewn as the Ascension Islands. They are also to be seen under the same name in Gutiero's chart, engraved at Antwerp in 1562, also in the map of Fernao Vaz Dourado bearing date 1571. Some early writers have referred to these islands as the Sanson or Simson Group, but these are evidently abbreviations of Ascension. Again on Schoner's globe, made in 1520, and now at Nuremberg (Germany), they are named the Maiden Group, and are shewn to consist of seven islands; while Plancius, the Dutch cosmographer, on his chart of America and on his General Map, both of which were drawn in 1594, shews the Ascension Islands.

And now, from the unknown foreign navigator, we come to the known British navigator. We must endeavour to imagine ourselves in Plymouth on the 26th August, 1591, and in front of us "three tall

* Read before the Royal Geographical Society of Australasia, Queensland, Novr. 25th, 1909.

ships and two barkes," about to start for "the Philippines and the coast of China," via Cape Horn. These vessels were:—

The *Galeon* under Admiral Cavendish, who was chief of the expedition.
The *Roebucke* under Vice-Admiral Cocke.
The *Desire* under Captain John Davis.
The *Black Pinesse* under Captain Tobie.
The *Daintie* under Captain Cotton.

After a severe gale off Cape St. Vincent, the *Daintie* returned home. In this tempest the vessels got separated, the instructions, however, were that they were to meet at Port Desire, on the east coast of Patagonia. Here they afterwards met, and in due course reached the Straits of Magellan, but there experienced the most terrible gales and blizzards, and, according to Cavendish himself, "In seven or eight days there dyed fortie men and sickened seventie, so that there were not fiftie men that were able to stand upon the hatches." The expedition was therefore forced to put back and determined to return to Brazil. When in Latitude 47 South the ships got separated at night, and the *Desire* (Captain Davis) and the *Black Pinesse* thinking that Cavendish had sustained some damage and would bear up for Port Desire proceeded thither, and after much buffeting reached the harbour on the 2nd June, 1592, to find that the other ships were not there. The vessels required refitting badly, and were not ready for sea till the 6th August. The following extracts are taken from the journal of John Jane, the historian of the voyage.

"And because famine was like to bee the best ende, wee desired to goe for Port Desire, hoping with seales and penguins to relieve ourselves, and so to make shift to followe the Generall (Cavendish), or there to stay his comming from Brazil. The 24 May wee had much winde at North. The 25 was calme, and the sea very loftie, so that our ship had dangerous foule weather. The 26 our fore-shrowdes brake, so that if wee had not beene neere the shoare, it had beene impossible for us to get out of the sea. And nowe being here mored in Port Desire, our shroudes are all rotten, not having a running rope whereto wee may trust, and being provided onely of one shift of sailes all worne. . . . . Wee began to travell for our lives, and wee built up a smiths forge and made a colepit, and burnt coles, and there wee made nails, bolts, and spikes, others made ropes of a peece of our cable, and the rest gathered muskles and took smeltes for the whole companie. Three leagues from this harborough there is an Isle with four small Isles about it, where there are great abundance of seals, and at the time of the yeere the penguins come thither in

great plentie to breede. Wee concluded with the pinnesse that she should sometimes goe thither to fetch seales for us; upon which conditions wee would share our vituals with her man for man; whereunto the whole companie agreed. Se wee parted our poore store, and shee laboured to fetch us seales to eate, wherewith wee lived when smeltes and muskles failed; for in the nepe streames wee could get no muskles. Thus in most miserable calamitie wee remained untill the sixt of August, still keeping watch upon the hils to looke for our Generall, and so great was our vexation and anguish of soule, as I thinke never flesh and blood endured more. Thus our miserie dayly increasing, time passing, and our hope of the Generall being very colde, our Captaine and Master were fully persuaded, that the Generall might perhaps goe directly for The Streights and not come to this harborough; whereupon they thought no course more convenient then to goe presently for The Streights, and there to stay his comming, for in that place hee could not passe, but of force wee must see him: whereunto the companie most willingly consented, as also the Captaine and Master of the pinnesse; so that upon this determination wee made all possible speede to depart.

The sixt of August (1592) wee set saile and went to Penguin-isle, and the next day wee salted twentie hogsheads of seales, which was as much as our salt could possibly doe, and so wee departed for The Streights the poorest wretches that ever were created.

The seventh of August towarde night wee departed from Penguin-isle, shaping our course for The Streights, where wee had full confidence to meete with our Generall.

The ninth wee had a sore storme, so that wee were constrained to hull, for our sailes were not to indure any force. The 14 wee were driven in among certaine Isles never before discovered by any knowen relation, lying fiftie leagues or better from the shoare East and Northerly from The Streights; in which place, unlesse it had pleased Gŏd of his wonderful mercie to have ceased the winde, wee must of necessitie have perished. But the winde shifting to the East, wee directed our course for The Streights and the 18 of August wee fell with the Cape (Virgin) in a very thick fogge; and the same night wee ankered ten leagues within the Cape."

These Isles were the Falkland Islands.

It is interesting to note that Davis himself is known to have written an account of his voyage, and it is much to be regretted that both his account and his survey are nowhere to be found. Admiral Berney when writing the account of the second voyage of Cavendish to the South Sea adopted the name of "Davis's Southern Islands" for the Falkland Islands.

Two years later (1594), Sir Richard Hawkins sailed along the northern shores of the Falklands, and being ignorant of Davis's discovery named them Hawkins' Maiden-land, and thus describes them :—

"The 2nd of February, about 9 in the morning, we descried land, which bore S.W. of us, which we looked not for so timely ; and in coming nearer to it, by the lying, we could not conjecture what land it should be ; for we were next of anything in 48 degrees, and no sea card which we had made mention of any land which lay in that manner, near about that height ; in fine we brought our larboard tack aboard, and stood N.E. all that day and night following ; in which time we made account we discovered near three score leagues of the coast. It is bold, and made small show of danger. The land, for that it was discovered in the reign of Queen Elizabeth, my Sovereign Lady and a Maiden Queen, and at my cost, in perpetual memory of her chastity, and of my endeavours, I gave it the name of Hawkins' Maiden-land. The land is a good champain country."

Hawkins' account of his voyage appearing before Davis wrote his "Worldes Hydrographical Description," published in May, 1595, and coming prominently before the public, the Group retained the name "Hawkins' Maiden-land" until the visit of Strong nearly one hundred years afterwards.

Some two or three years after the visit of Hawkins, the Dutch navigator Sebald de Weert saw the Jason Islands (which lie to the N.W. of the Group) and thought he had made a fresh discovery, and the States of Holland in 1598 termed them the Isles of Sebald de Weert, after their Admiral, which led to their being known as the Sebaldine Isles. They were likewise termed by the Dutch Nova Belgia.

In 1683-4 the English navigators Dampier and Cowley saw three islands in latitude 51° to 51°-20′ S., which they rightly supposed were those seen by Sebald de Weert. Shortly afterwards, however, the Editor of Cowley's narrative published a different latitude for the land they saw, and called it Pepys Island, after the then Secretary of the Admiralty the author of the famous Pepys Diary, and gave the latitude as 47 degrees South. This occasioned a great deal of confusion later, and several searches were made for Pepys Island.

In 1690 Strong in the *Welfare* not only sailed between the East and West Falkland, but anchored repeatedly and landed. The journal of the *Welfare* written by Strong is in the British Museum, together with "Observations during a South Sea Voyage," written by Richard Simson, who sailed in the same ship. The following

extracts from these authors are to be found in Admiral Fitzroy's "Voyage of the Beagle," Vol. II. :—

"1690. Monday 27th January. We saw the land ; when within three or four leagues, we had thirty-six fathoms. It is a large land, and lieth east and west nearest. There are several quays that lie among the shore. We sent our boat to one, and she brought on board abundance of penguins, and other fowls, and seals. We steered along shore E. by N., and at eight at night we saw the land run eastward as far as we could discern. Lat 51° 3′ S.

"Tuesday 26th. This morning at four o'clock we saw a rock that lieth from the main island four or five leagues. It maketh like a sail.* At six we stood into a sound that lies about twenty leagues from the westermost land we had seen. The sound lieth south and north nearest. There is twenty-four fathoms depth at the entrance, which is four leagues wide. We came to an anchor six or seven leagues within, in fourteen fathoms of water. Here are many good harbours. We found fresh water in plenty, and killed abundance of geese and ducks. As for wood, there is none.

"On the 31st we weighed from this harbour, with the wind at W.S.W. We sent our long-boat a-head of the ship, to sound before us. At eight o'clock in the evening we anchored in nine fathoms. The next morning we weighed, and sent our boat before us. At ten we were clear out of the sound. At twelve, we set the west cape bearing N.N.E., which we named Cape Farewell. This Sound, Falkland Sound, as I named it, is about seventeen leagues long ; the first entrance lies S. by E., and afterwards S. by W.

It is curious that the name Falkland given by Strong to the Sound after the then Lord Falkland, the Treasurer of the Navy, should have obliterated that of Hawkins' Maiden-land, and become the English name of the Group. Some thirty miles to the South of the East Falkland is the small island of Beauchene, called after the French navigator Beauchesne Gouin, who discovered it in 1699.

In Captain Woodes Rogers' report of his "Cruising Voyage Round the World, with the ships *Duke* and *Duchess of Bristol*"—the map attached to which shews Pepys Island—he states, writing under the date of December 23, 1708, "At ten this morning we saw land bearing S.S.E. distant nine leagues. It appeared first in three, afterwards in several more islands. At twelve it bore S. ½W. the west end distant six leagues, a long tract of land. We saw most of that which appeared to be islands, join with the low lands. The

* Now called Eddystone, seen by Hawkins and named by him "White Conduit." Bougainville termed it Tower of Biffy.

wind being westerly, and blowing fresh we could not weather it, but was forced to bear away and run along shore, from 3 to 4 leagues distant. It lay as near as we could guess E.N.E. and W.S.W. This is Falklands Land, described in few draughts, and none lay it down right, tho the latitude agrees pretty well. The middle of it lies in latitude 51,00. S., and I make the longitude of it to be 61,54 West from London." On the 24th and 25th Rogers hung about the land, and towards evening espied a sail to which he gave chase. He lost her but puts her down as "A French homeward bound ship from the South Seas."

Between the years 1706 and 1714 French ships belonging to St. Malo passed near the Falklands when proceeding to and returning from Chile and Peru, with which countries France then had a lucrative trade. The French navigator Frezier in the report of his "Voyage to the South Sea," printed in Paris in 1716, stated as follows when referring to the chart he had prepared:—

"If in this chart I have suppressed some supposed countries, I have added others which are real, in the latitude of 51 degrees, and to which I have given the name of New Islands; because they have been discovered since the year 1700, the greatest part of them by the ships of St. Malo. I have placed them according to the reports of the *Maurepas* and *St. Louis*, ships belonging to the India Company, which had a near view of them, and the latter even took in fresh water there from a pond, which I have marked near Port St. Louis. The water here was reddish, and somewhat insipid, in other respects, good for the sea. Both these vessels passed them in different parts, but the one which kept closest along the coast was the *St. John Baptist* commanded by Doublet of Harve, who attempted to pass through an opening he saw towards the middle of them; but perceiving several small islands just rising to the surface of the water, he thought proper to tack about. This cluster of islands is the same which was discovered by Fouquet of St. Malo, and to which he gave the name of Anican, his owner. The routs I have traced will show the bearings of these lands from the Streights of Le Maire, in her passage from which the *St. John Baptist* saw them, and from Statenland, which the other two ships had had a prospect of before they found it. . . . .

"These islands are certainly the same, which were discovered by Sir Richard Hawkins in 1593, to the east of the uninhabited coast and in 50 degrees latitude. . .

"Hitherto these lands have been called Sebald's Islands, it being supposed that the three which go under this name in the charts were situated there at pleasure, for want of a proper knowledge of them. But the ship *L'Incarnation*, commanded by the Sieur

Brignon of St. Malo, took a near view of them in fine weather in the year 1711 on her departure from Rio Janiero. They are in fact three small islands of about half a league in length ranged in a triangular form, as they are represented in the charts. They passed at the distance of three or four leagues from them, and saw no land, though the weather was very fine, which is a proof that they are separated from the New Islands by at least seven or eight leagues."

In consequence of the visits of the ships of St. Malo the French named the Islands "Les Malouines," but this was not till after 1716 when Frezier compiled the chart already referred to in which he termed them the New Islands (Isles Nouvelles).

On the 8th August, 1740, the English Government despatched an expedition to the South Seas under Mr. (afterwards Lord) Anson, consisting of the *Centurion*, *Gloucester*, *Severn*, *Pearl*, *Wager*, and *Tryal*. It was foreseen that a war with Spain was inevitable, and it was considered that if attacked in her distant Settlements she would be deprived of the returns of that treasure by which alone she was enabled to carry on war. Although Lord Anson never visited the Falkland Islands, he did more than any other person, either before or since, to draw attention to their importance; in fact, had it not been for Lord Anson's recommendations, it is doubtful whether the Union Jack would now be flying over the Colony. These are his own words:—

"Thus having given the best directions in my power for the success of our cruisers, who may be hereafter bound to the South Seas; it might be expected that I should again resume the thread of my narration. Yet, as both in the preceding and subsequent parts of this work, I have thought it my duty, not only to recite all such facts, and to inculcate such maxims as had the least appearance of proving beneficial to future navigators, but also occasionally to recommend such measures to the public, as I conceive are adapted to promote the same laudable purpose; I cannot desist from the present subject, without beseeching those to whom the conduct of our naval affairs is committed, to endeavour to remove the many perplexities and embarrassments with which the navigation to the South Seas is at present, necessarily encumbered. An effort of this kind could not fail of proving highly honourable to themselves, and extremely beneficial to their country. For it seems to me sufficiently evident, that whatever improvements navigation shall receive, either by the invention of methods that shall render its practice less hazardous, or by the more accurate delineation of the coasts, roads, and ports, already known, or by the discovery of new nations, or new species of commerce; it seems, I say, sufficiently evident, that by whatever means navigation

is promoted, the conveniences hence arising almost ultimately redound to the emolument of Great Britain. Since as our fleets are at present superior to those of the whole world united; it must be a matchless degree of supineness or mean-spiritedness, if we permitted any of the advantages which new discoveries, or a more extended navigation, may produce to mankind, to be ravished from us.

"As therefore it appears that all our future expeditions to the South Seas must run a considerable risk of proving abortive, whilst in our passage thither, we are under the necessity of touching at Brazil; the discovery of some place more to the southward, where ships might refresh and supply themselves with the necessary sea-stock for their voyage round Cape Horn, would be an expedient which would relieve us from this embarrassment, and would surely be a matter worthy of the attention of the public. Nor does this seem difficult to be effected. For we have already the imperfect knowledge of two places, which might perhaps, on examination, prove extremely convenient for this purpose. One of them is Pepy's Island, in the latitude of 47 South, and laid down by Dr. Halley, about eighty leagues to the eastward of Cape Blanco, on the coast of Patagonia; the other is Falkland's Isles, in the latitude of 51½ degrees, lying nearly South of Pepy's Island. The first of these was discovered by Captain Cowley, is his Voyage round the World in the year 1686; who represents it as a commodious place for ships to wood and water at, and says, it is provided with a very good and capacious harbour, where a thousand sail of ships might ride at anchor in great safety; that it abounds with fowls, and that as the shore is either rocks or sands, it seems to promise great plenty of fish. The second place, or Falkland's Isles, have been seen by many ships, both French and English, being the land laid down by Frezier, in his chart of the extremity of South America, under the title of the New Islands. Woods Rogers, who run along the N.E. coast of these Isles in the year 1708, tells us, that they extended about two degrees in length, and appeared with gentle descents from hill to hill, and seemed to be good ground, interspersed with woods, and not destitute of harbours. Either of these places, as they are Islands, at a considerable distance from the Continent, may be supposed, from their latitude to lie in a climate sufficiently temperate. It is true, they are too little known to be at present recommended as the most eligible places of refreshment for ships bound to the southward. But if the Admiralty should think it advisable to order them to be surveyed, which may be done at a very small expense, by a vessel fitted out on purpose; and if, on this examination, one or both of these places should appear proper for

the purpose intended, it is scarcely to be conceived, of what prodigious import a convenient station might prove, situated so far to the southward, and so near Cape Horn. The *Duke and Duchess of Bristol* were but thirty-five days from their losing sight of Falkland's Isles to their arrival at Juan Fernandez in the South Seas; and as the returning back is much facilitated by the western winds, I doubt not but a voyage might be made from Falkland's Isles to Juan Fernandez and back again, in a little more than two months. This, even in time of peace, might be of great consequence to this nation, and, in time of war, would make us masters of those seas."

After the decisive battle of Quebec in 1759 Canada became British, and M. de Bougainville, Knight of St. Louis, and Colonel of Infantry, who was one of Montcalm's Officers, returned to France with his mind full of a great scheme whereby his country was to be compensated for her Colonial losses. The story is best told in the words of Dom Pernety, the historian who accompanied M. de Bougainville in his expedition to the Falkland Islands in 1763 and 1764.

"After the peace was concluded by a cession of all Canada on the part of France to England, M. de Bougainville, Knight of St. Louis, and Colonel of Infantry, conceived the design of indemnifying France for this loss, if possible, by a discovery of the southern continent and of those large islands, which lie in the way of it. A perusal of Admiral Anson's voyage round the world fixed his ideas for finding the Malouine Islands, and determined him to make them the first object of his expedition, and to form a settlement there. He communicated his project to the Ministry, who approved it. To carry it therefore into execution, M. de Bougainville caused a frigate and a sloop to be built at St. Malo at his own expense."

In due course the frigate *Eagle* and the sloop *Sphinx* left St. Malo (8 Sept., 1763), and on the 31st January, 1764, the Falklands were sighted. It is desirable at this point to lay emphasis on the fact that Bougainville had on board his vessels everything that was necessary to start a settlement, including settlers, cows, calves, goats, sheep, hogs, and horses. These animals were brought from St. Catherine's Island, Brazil, and Montevideo. But although the gallant de Bougainville and his companions, including the first settlers of this Colony, were now nearing their destination, they had still some severe experiences to go through before anchoring at the future settlement. This is apparent from the following extracts from Dom Pernety's journal.

"In the afternoon of the 31st (1764, Jan.), we coasted along the shore, at the distance of about a league and sometimes only half a league, in order to observe it with greater advantage. We

sounded from time to time at thirty-five fathom depth, grey sandy bottom. . . .

"At three o'clock we saw a small island two leagues wide of the coast. It nearly resembled in figure that on which the Fort de la Conchée near St. Malo is built. M. Bougainville gave it the name of the Tower of Biffy. At five, we discovered a Cape, and a small island, resembling Cape Frehal, situated four leagues from St. Malo. This Cape seemed to terminate the land to the east.

"On the first of February, we perceived another Cape and a small island almost similar to those which reminded us of Cape Frehal; and after that, another small one intirely covered with birds. At noon, the wind blowing strong with squalls and rain, caused so violent a rolling of the ship, that our cattle suffered much from it. At last we determined to kill several sick cows, fearing they should die, and we should be obliged to throw them overboard, as we had the fine bull we had brought with us from St. Catherine's Island, as well as some goats and several sheep.

"At six in the evening the weather being fine, with a gentle breeze, we determined to send out the fishing boat which was manned for that purpose. Messrs. Donat and Le Roy the Lieutenant, went on board with a sufficient number of seamen, all well armed. They were sent on shore to cut grass for our cattle, who began to be in want of it. We were then about two leagues from the point which appeared woody. We were becalmed till about eight o'clock. The tide drove us towards the shore upon a shoal of rocks. In this embarrassing situation, from which it was impossible to extricate ourselves for the want of wind, we sounded with a view of casting anchor, if the bottom should be good. But the bottom proving rocky at between eighteen and twenty fathom, our perplexity increased, and with the more reason as the tide had already carried us towards the shoal, which lined a pretty large creek, and we were scarce half a quarter of a league from it. The *Sphinx* laboured under the same difficulty, and we were already contriving means to save our lives in case we should be shipwrecked upon these rocks, which the mariners call the Carpenters; because the ship which has the misfortune to run aground here, is soon dashed to pieces. Fortunately, about eight o'clock, a very faint breeze blew from the shore; and our officers, equally attentive and able to avail themselves of the smallest advantage ordered the working of the ship so skilfully, that we got clear of the shore. The ship's crew were so fully sensible of the danger we were in, that in the most tempestuous weather, and even during the storm we suffered near the Maldonnades, they never worked the ship with so much alacrity and diligence. It was a fine sight to see everyone at

his post, holding in his hands the ropes he was to manage ; all, in an attitude, in which was pictured anxiety and fear mixed with hope ; all, observing the most profound silence, their eyes fixed upon the Captain, and their ears attentive to catch the first word of command ; the two Captains and the Lieutenants, and all the ship's company, employed in looking, some on the side of the ship towards the sea, others towards the land, to observe if anyone could perceive the smallest breeze rising, and ruffling the surface of the water which was almost as smooth as glass. One turned his cheek, another held his hand, and a third wetting his, extended it towards the quarter from which they imagined the wind began to blow in order to perceive the least motion. At length the long-wished for breeze arose, but blew very faintly ; fear gave place to joy and satisfaction, and to prevent our being again involved in the same difficulties, we steered away North East ¼ East, five degrees East.

"At eleven our fishing boat returned loaded with greens, and was taken on board. Messrs. Donat and Le Roy informed us, that they had seen at land, about the distance of a musket-shot from the place they were in, an animal of a terrible appearance and astonishing size lying upon the grass ; his head and mane resembling a lion's and his whole body covered with hair, of a dusky red as long as a goat's. This animal perceiving them, raised himself upon his fore-feet, eyed them a moment, and then lay down again ; having afterwards fired at a bustard, which they killed, the enormous animal raised himself a second time, eyed them as before without changing his situation, and then lay down again. According to their account, this animal seemed to be as large as two oxen, and twelve or fourteen feet in length. They had a mind to fire at him, but they were terrified and durst not fire for fear of wounding him slightly and hazarding their lives ; or, according to their own account, they were unwilling to lose time, as it was late, and they were desirous of returning on board.

"On the third (1764, Feb.,) we discovered an opening of a bay, the entrance of which appeared so fine, that we went into it full sail, as into a well-known and commodious harbour. . . . .

"On Saturday the 17th, in the morning, we put into the great boat the two Acadian families we had brought with us to make a settlement on this island, and to people it. At nine in the morning they landed with all their clothes, furniture, and necessary utensils, provisions, and some tents to accommodate such of the crews as were to remain on shore to assist in establishing the settlement. . .

"On Saturday the 25th, M. de Bougainville proposed at breakfast to both land and sea officers, to undertake the erecting of a fort

upon the rising ground forming the hill, on which the habitation or place of residence was built for the colonists, who were to remain on the island. We all unanimously agreed to erect it with our own hands, and to complete it without the assistance of the rest of the ship's company. . . . .

"About three in the afternoon, we met at the place where the fort was marked out, which we agreed to call Fort du Roy, or Fort Royal. Everybody set to work with so much cheerfulness, and such incredible ardor, that we had the very same evening dug part of the ditch six feet broad and one deep. M. de Bougainville's example animated us all. . . .

"On the second of March, at nine in the morning, we landed four pieces of cannon out of the ten which the *Eagle* was to furnish for the defence of the fort we were erecting. Four more will be added from on board the *Sphinx ;* two brass field pieces, which were bought at St. Malo's two days before our departure, and six pedereroes. As we determined to raise a pyramid in form of an obelisk in the centre of the fort, I proposed to place a bust of Louis the fifteenth upon the top, and undertook to execute it in terracotta. . . . .

"Ever since we set about building our habitation, we fired a field piece, with a pound ball, and rang a bell at five every morning, and half-past seven every evening, to summon the men to their work, and give them notice when to leave off. At eight we rang to breakfast, and at one to dinner. Besides these meals M. de Bougainville now and then ordered them an allowance of brandy by way of gratuity. Thus the work was actually in as great forwardness as if two hundred workmen had been employed. . . .

(5 April, 1764). "All the Company being assembled at the fort, the pyramid was opened : I then solemnly sang the Te Deum. . . We cried Vive le Roy seven times and fired twenty-one cannon. We cried again seven times Vive le Roy. M. de Bougainville then produced the King's Commission, appointing a Governor in the new Colony, which was delivered to M. de Nerville, who was immediately received and acknowledged as such. M. de Bougainville, in the King's name, likewise proclaimed the other officers, who were in the same manner unanimously acknowledged. . . . .

(June, 1764). "M. de Bougainville having given the King (Louis XV.) an account of our expedition, His Majesty ratified the taking of the Malouine Islands, and immediately issued orders for the *Eagle* to be got ready to return to these islands."

The French Colony, however, although started under such apparently favourable auspices, was destined to be but short lived. Spain hearing of the settlement at once took exception to it, and

laid claim to the Islands as forming part of her South American possessions, while France under pressure of various considerations agreed to deliver up her newly-formed Colony subject to the payment of an indemnity to the projectors and Colonists of some £25,000. This done France gave over possession on April 1, 1767, to the Spanish officer appointed to take charge. The standard of Spain was hoisted and royal salutes fired. The Group hereafter became known by the Spaniards as Islas Malvinas or Islas de Magallanes.

It is apparent then that the Falkland Islands have at successive periods been designated by the following names :—Davis' Southern Islands ; Hawkins' Maiden Land ; Isles of Sebald de Weert, or Sebaldine Isles ; Nova Belgia ; Falkland Islands ; Pepys Island ; Anican Islands ; Isles Nouvelles ; Les Malouines ; and Islas Malvinas or Islas de Magallanes.

It seems doubtful, however, whether the transfer to the Crown of Spain was altogether appreciated by the Spaniards, whose duty compelled them to reside at Port Louis. The following extract from Thomas Falkner's account of the Falklands, published in 1774, is interesting :—" The Spaniards transported with their Colony two Franciscan Friars, and a Governor or Vice-Governor ; who, beholding their settlement, were overwhelmed with grief ; and the Governor, Colonel Catani, at the departure of the ships for Buenos Aires, with tears in his eyes declared, that he thought those happy who got from so miserable a country, and that he himself should be very glad if he was permitted to throw up his commission, and return to Buenos Aires, though in no higher station than that of a cabin boy."

We must now retrace our steps for a period of three years, and go back to 1764. In that year, and as the outcome of Lord Anson's representations, a squadron was despatched to the South Seas, by the order of King George the Third under the command of Commodore the Hon. John Byron. It was this same John Byron who was on board the unfortunate vessel *Wager*, one of Lord Anson's squadron, when she went ashore, and was lost on the Chilian coast to the north of the Straits of Magellan in 1741, and had such perilous experiences before he reached England in 1746. The following extract from, " An affecting narrative of the unfortunate voyage and catastrophe of H.M.S. *Wager*," shows how one of the islands of this Colony received its name, " On Monday the 12th of October, 1741, the long-boat was launched with great transports of joy, and christened the *Speedwell*."

The Royal instructions already referred to and dated 17 June, 1764, ran as follows :—" And whereas His Majesty's Islands, called Pepys Island and Falkland Islands, lying within the said track (the

track between the Cape of Good Hope and the Straits of Magellan), notwithstanding their having been first discovered and visited by British navigators, have never yet been so sufficiently surveyed, as that an accurate judgment may be formed of their coasts and product, His Majesty, taking the premises into consideration, and conceiving no juncture so proper for enterprises of this nature as a time of profound peace, which his kingdoms at present happily enjoy, has thought fit that it should now be undertaken."

The expedition started, and on January 13, 1765, land was seen, and on the 15th a commodious harbour was entered to which was given the name of Port Egmont, in honour of the first Lord of the Admiralty. On the 23rd Commodore Byron went ashore with the Captains of the *Dolphin* and *Tamer*, "where the Union Jack was erected on a high staff, and being spread, the Commodore named the whole His Majesty's Isles, which he claimed for the Crown of Great Britain, his heirs and successors. The colours were no sooner spread than a salute was fired from the ship."

Commodore Byron's report on the Islands was so favourable that Captain Macbride was sent out in H.M.S. *Jason* to commence their colonisation, and he arrived on the 8th of January, 1766. He erected a small blockhouse and stationed a garrison at Port Egmont. Cattle, goats, sheep, and hogs were introduced and found to thrive. Captain Macbride, however, was less favourably impressed with the country than Commodore Byron. He reported that geese were scarce and foxes abundant, and that the number of sea-lions and penguins, which he termed "vermin" were incredible. To quote his own words, "The garrison lived upon Falkland's Islands, shrinking from the blast, and shuddering at the billows," and then again, "We supposed that we should be permitted to reside in Falkland's Islands the undisputed lords of tempest-beaten barrenness."

Notwithstanding the drawbacks above mentioned the colonisation continued without incidents of special note until the 28th November, 1769, when Captain Hunt, the military Governor, observing a Spanish schooner hovering about the island and surveying it, sent the Commander a message requiring him to depart. The Spaniard returned, however, in two days with a letter from the Governor of Port Solidad, the name given by the Spaniards to the settlement at Port Louis, complaining that when Captain Hunt ordered the schooner to depart he had assumed a power to which he had no pretensions, by sending an imperious message to the Spaniards in the King of Spain's own dominions. In reply Captain Hunt warned the Spaniards from the Islands which he claimed in the name of the King, and as belonging to the English by right of the first discovery and the first settlement.

On the 12th of December the Governor of Port Solidad formally warned Captain Hunt to leave Port Egmont, and to forbear the navigation of these seas without permission from the King of Spain. Captain Hunt, in reply, repeated his former claim, declared that his orders were to keep possession, and once more warned the Spaniards to depart. After some further interchange of letters in the same strain the correspondence ceased for a few months

Early in June, 1770, however, a Spanish frigate, the *Industry*, commanded by Commodore John Ignacio Madariaga, anchored in Port Egmont, bound, as was said, for Port Solidad and badly in need of water after a passage of 53 days from Buenos Aires, and on the 3rd June was ordered to leave as explained in the following letter from Captain Maltby of H.M. Frigate *Favourite*.

Copy of a letter from Captain William Maltby, of His Majesty's Frigate the *Favourite*, to the Spanish Commodore, dated in Port Egmont. June 3, 1770.

Sir,

As you have received the Refreshments of Water, &c., you stood in Need of, my Orders from His Britannic Majesty, my Royal Master, are to warn you forthwith to quit this Harbour and Islands, called Falkland's, having first been discovered by the Subjects of the Crown of England, sent out by the Government thereof for that Purpose, and of Right belonging to His Majesty; and his Majesty having given Orders for the Settlement thereof, the Subjects of no other Power can have any Title to establish themselves therein without the King's Permission.

I am, &c.,

(signed) William Maltby.

Three days afterwards four other Spanish frigates entered the port, and on the 8th June the Spanish Commodore wrote both to Captain Farmer, who then commanded the garrison, and to Captain Maltby of the *Favourite*, and ordered them to quit the port, and threatened in case of their not doing so to proceed to hostilities. The following is the letter to Captain Farmer and his reply.

Copy of a letter from the Spanish Commodore John Ignacio Madariaga to Captain George Farmer, dated in the Bay of Cruizada, the 8th of June, 1770.

My dear Sir,

Finding myself with incomparable superior Forces of Troops, Train of Artillery, Utensils, Ammunition, and all the rest corresponding, for to reduce a regular fortification, with 1,400 men for disembarking, for which 526 are of choice regular Troops, as you may see, I see myself in this Case obliged to intimate to you, according to the Orders of my Court, that you should quit that begun Establishment; for

if you don't execute it amicably, I will oblige you by Force, and you will be answerable for all the ill Results of the Action and Measures I shall take. I am always at your Service, pray unto God to preserve you many years.

I kiss your Hand, &c.,
(signed) John Ignacio Madariaga.

Copy of a letter from Captain Farmer to the Spanish Commodore John Ignacio Madariaga dated at Port Egmont, the 9th of Jun , 1770.

Sir,

Your letters of the 8th and this Day's Date I have received, in which you threaten, pursuant to your Orders, to send me from hence by Force of Arms. Words are not always deemed Hostilities, nor can I think you mean, in a Time of profound Peace, to put them in Execution, more especially as you allow there now subsists the greatest Harmony between the Two Crowns.

I make not the least Doubt of your being thoroughly convinced, that the King of Great Britain, my Royal Master, has forces sufficient to demand Satisfaction in all parts of the Globe, of any Power whatsoever, that may offer to insult the British Flag. Therefore was the Time limited shorter than the fifteen Minutes you have allowed, it should make no alteration in my determined Resolution to Defend the Charge committed to me, to the utmost of my Power,

and am, &c.,
(signed) George Farmer.

On the following day (10th) Madariaga landed his forces and as the English only had a wooden blockhouse, with a small battery of cannon, they were shortly compelled to capitulate and quit the Islands. It is but right to say that the Spanish Commodore allowed them to leave Port Egmont with every honour, to remove anything they wanted, and that an inventory of all the stores and effects left was drawn up and signed for by the Auditor of His Catholic Majesty's Navy.

When the news reached England there was great indignation, and satisfaction was at once demanded from Spain for the insult and injury inflicted. At first Spain argued and temporized, but as Great Britain continued firm she relinquished her views, disavowed the act of her officer, and in 1771 restored Port Egmont, and the colonisation continued. The mobilisation of the English fleet on this occasion, owing to the above mentioned strained relations, is interesting, as it led to the going to sea of young Horatio Nelson, afterwards England's greatest naval hero. The action of Great Britain in 1771 with regard to the Falklands produced the well known controversy between Junius and Dr. Johnson. Junius, who wrote

acrimoniously for fame, severely censured the policy of the Government while Dr. Johnson, who wrote for bread, brilliantly defended the Ministry.

On the 15th November, 1772, the last expedition to Port Egmont left England. It was sent out there in the *Endeavour* storeship, and had on board in pieces the armed shallop *Penguin* of 36 tons, mounting ten swivels. The Surgeon's Mate, Bernard Penrose, has drawn aside the screen and has thus described the settlement as it then was :—

" It was situated on the south side of an island, named Saunder's, from whence there was a view of the whole harbour called Port Egmont. Its ornament and defence was a large timber blockhouse, which had been framed in England, and carried out in pieces as our shallop was. It could mount four guns, and had a good command of the landing place ; but if attacked with any considerable force, it was incapable of much resistance, but must capitulate on any terms ; for on the enemies firing a tar-barrel under it, they might soon reduce it to ashes. This fort we found converted into a store-house on account of its capaciousness and security, and as such we used it during our continuance on the island. Besides this, there were some other buildings of an inferior construction, erected by the unskilful hands of marine architects out of what materials the shore afforded, such as stones and sods, and thatched for the most part with Penguin grass (tussac grass). In the most splendid of these, which was covered with tarred canvas, the Captain of the *Hound* had taken up his residence while he was Governor of the place ; and in this dwelling he was succeeded by our Commander, Lieutenant Clayton, who had the area in the front enclosed, for distinction's sake, with a small parapet wall, on which the shallop's swivels were mounted, and which we fired on every occasion of rejoicing Not far from hence was a house of somewhat less elegance appropriated to the use of the petty officers, whose inferiority of rank might be discovered at a distance by another circumstance besides that of the battery ; for whereas the chimney of the chief officer's mansion was made out of an old ship's funnel, that of the others was composed of a cask clapped on the roof. The habitation of the private men was a long building, which Captain Burr had raised as an additional store, and it is easy to conceive it did not excel the rest in magnificence. But it must not be imagined that these hastily erected edifices were in the best repair ; we found at our taking possession of them, that they required much attention, in order to make them weather-proof ; which we effected, by giving them an additional wall of sods, and binding on new thatch upon the rafters, which were mostly ribs of

whales that had been cast on the beach. We had likewise two sheds, one for the carpenters, and another for the smiths, and at the distance of a musket from the blockhouse was an enclosure with a slight hovel within it, occupied by the people who took care of the little live stock we had among us. But the glory of our Colony was the gardens, which we cultivated with the greatest care, as being fully convinced how much the comforts of our situation depended upon our being plentifully supplied with vegetables." Then follows a list of thirteen vegetables which they produced.

On the 23rd April, 1774, the *Endeavour* sailed into Port Egmont with instructions that the settlement was to be evacuated, but that the marks and signals of possession and property were to be left upon the islands, to indicate the right of possession, and to shew that the occupation might be resumed. On May 20th a formal leave of the Islands was taken, and the following inscription, engraved on a piece of lead, was affixed to the door of the blockhouse.

" Be it known to all nations,

" That Falkland's Island, with this fort, the storehouses, wharfs, harbours, bays, and creeks thereunto belonging, are the sole right and property of His Most Sacred Majesty George the Third, King of Great Britain, France and Ireland, Defender of the Faith, &c. In witness whereof this plate is set up, and His Britannic Majesty's colours left flying as a mark of possession by S. W. Clayton, Commanding Officer at Falkland's Island, A.D. 1774."

For years after this the Islands remained unnoticed but not forgotten by England.

The Spaniards are supposed to have withdrawn their small garrison from Port Solidad early in 1800 though the exact date does not appear to be known. Admiral Fitzroy, who is no mean authority, states, " From 1810 to 1820 there was no person upon these islands (the Falklands) who claimed even a shadow of authority over them."

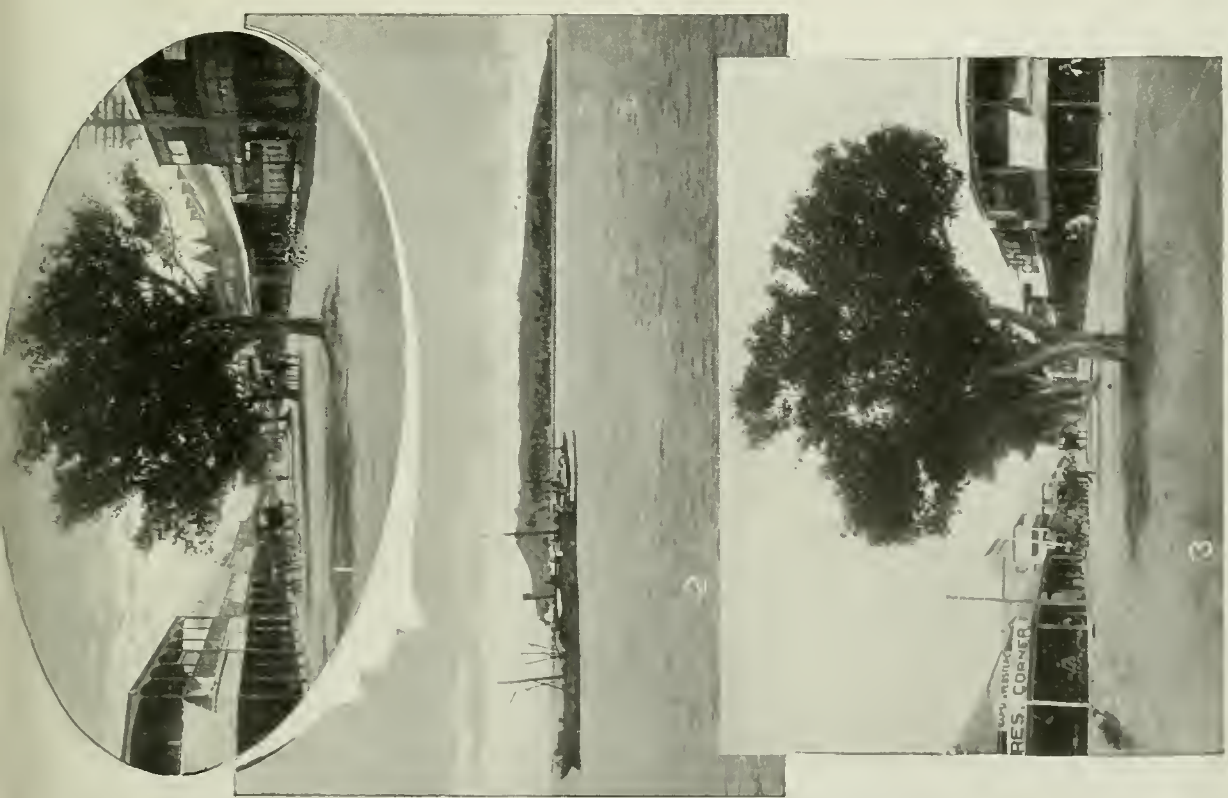
In November, 1820, Captain Weddell, R.N., when on a voyage towards the South Pole, and while anchored at Port St. Salvador, received the following letter from Commander Jewitt of the frigate *Heroind*.

" National Frigate Heroind
at Port Solidad, November 2nd, 1820.

" Sir,

I have the honour to inform you of the circumstance of my arrival at this port, commissioned by the Supreme government of the United Provinces of South America to take possession of these islands in the name of the country to which they naturally appertain

VIEW OF GLADSTONE HARBOUR, NORTH COAST RAILWAY, CENTRAL QUEENSLAND.



VIEWS OF MACKAY, NORTH QUEENSLAND.

1. Sydney Street. 2. Flat-top Island Anchorage. 3. Victoria Street.

FISHER'S FALLS, NEAR INNISFAIL, NORTH QUEENSLAND.

VIEWS OF CAIRNS, NORTH QUEENSLAND.
1. Abbott Street. 2. The Esplanade. 3. The Wharves.

"In the performance of this duty, it is my desire to act towards all friendly flags with the most distinguished justice and politeness.

"A principal object is to prevent the wanton destruction of the sources of supply to those whose necessities compel or invite them to visit the islands, and to aid and assist such as require it to obtain a supply with the least trouble and expense.

"As your views do not enter into contravention or competition with these orders, and as I think mutual advantage may result from a personal interview, I invite you to pay me a visit on board my ship, where I shall be happy to accommodate you during your pleasure.

"I would also beg you, so far as comes within your sphere, to communicate this information to other British subjects in this vicinity.

"I have the honour to be,
"Sir,
"Your most obedient humble servant,
Jewitt,
"Colonel of the marine of the United Provinces of South America, and commander of the frigate *Heroind*."

Next day Captain Weddell walked to Port Louis and proceeded on board. He found that the *Heroind* had been at sea about eight months, and that the crew were stricken with scurvy. His offer to navigate the frigate up the Sound was accepted, and he brought her to a safe anchorage off the ruins of Port Louis. A few days afterwards Captain Jewitt took formal possession of the islands for the patriot government of Buenos Aires, read a declaration under their colours, planted on a port in ruins, and fired a salute of 21 guns.

This act of the Buenos Aires goverment was scarcely known in Europe for many years, and not until 1829 was it formally noticed and protested against by Great Britain.

In 1823, Lewis Vernet, by birth a German, obtained from the Buenos Aires Government the use of the fishery and of the cattle on the East Falkland, and also tracts of land thereon. This undertaking did not prosper. In 1826 Vernet proceeded there himself, and subsequently wrote, "After many sacrifices, I was enabled to surmount great obstacles, but still that which we expected to effect in one year was not realised before the expiration of five. My partners lost all hope, and sold me their shares. I bought successively three vessels, and lost them; I chartered five, one of which was lost. Each blow produced dismay in the Colonists, who several times resolved to leave that ungrateful region, but were restrained by their affection

for me, which I had known how to win, and by the example of constancy and patience which my family and myself held out to them."

In 1828 the Government of Buenos Aires granted to Mr. Vernet certain additional lands and the exclusive fishing rights in the Falkland Islands, and in June, 1829, he was apppointed by the Buenos Aires Government to be Governor of the Islands.

In this year (1829) Vernet warned off some North American sealers, and in 1831 upon their repeating the sealing excursions of which he had complained he detained them by force, and took them himself to Buenos Aires. Vernet's action was strongly resented by Captain Duncan of the U.S. Corvette *Lexington*, who on hearing of it (December, 1831), sailed from Buenos Aires to the Falklands, and on the 31st December, 1831, destroyed the settlement at Port Louis, made prisoners of many persons, including Mr. Brisbane, Mr. Vernet's Agent, and afterwards conveyed them to Buenos Aires and handed them over to the Government there.

Some few months before this occurrence a British Naval Officer, who happened to visit Port Louis thus describes Vernet's settlement:—
"The settlement is situated half round a small cove, which has a narrow entrance from the Sound; this entrance, in the time of the Spaniards, was commanded by two forts, both now in ruins, the only use made of one being to confine the wild cattle in its circular wall when newly brought in from the interior. The Governor, Lewis Vernet, received me with cordiality. He possesses much information, and speaks several languages. His house is long and low, of one story, with very thick walls of stone. I found it in a good library, of Spanish, German, and English works. A lively conversation passed at dinner, the party consisting of Mr. Vernet and his wife, Mr. Brisbane, and others; in the evening we had music and dancing. In the room was a grand piano-forte; Mrs. Vernet, a Buenos Airean lady, gave us some excellent singing, which sounded not a little strange at the Falkland Isles, where we expected to find only a few sealers.

"Mr. Vernet's establishment consisted of about fifteen slaves, bought by him from the Buenos Airean Government, on the condition of teaching them some useful employment, and having their services for a certain number of years, after which they were to be freed.

"The total number of persons on the Island consisted of about one hundred, including 25 gauchos and 5 Indians. There were two Dutch families (the women of which milked the cows and made butter); two or three Englishmen; a German family; and the remainder were Spaniards and Portuguese prentending to follow some trade, but doing little or nothing. The gauchos were chiefly Buenos Aireans, but their Capitaz or leader was a Frenchman."

It is worthy of note that a year or two prior to this Vernet produced in his small settlement in twelve months eighty tons of salted fish, partly rock cod, which netted £1,600 sterling in Brazil.

While the United States and Buenos Aires were discussing the question at issue, Great Britain, following up the solemn warnings she had given Buenos Aires, already referred to, issued orders to her Commander-in-Chief on the South American Station, to send a vessel of war to re-hoist the British Flag upon the Falkland Islands; to assert her right of sovereignty, and to cause everything belonging to the Buenos Airean Government to be embarked and sent away.

On the 2nd of January, 1833, H.M.S. *Clio* anchored in Berkeley Sound, and on the following day the Buenos Airean flag was lowered, and the British colours hoisted and saluted. H.M.S. *Tyne* performed the same ceremony about the same time at Port Egmont. On the departure of the *Clio*, the small Buenos Airean garrison having previously withdrawn quietly and sailed for the River Plate, the colours were entrusted by Commander Onslow to Mr. Matthew Brisbane, an Irishman, the Agent and partner of Mr. Vernet.

On the 26th August, 1833, three gauchos and five Indians set upon and barbarously murdered Mr. Brisbane, Mr. Dickson, the Capitaz, the German, and another settler, they then plundered the settlement, and drove the cattle and horses into the interior. The rest of the settlers escaped to a small island in the Sound. Brisbane fell by the knife of Antonio Rivero. Shortly after this H.M.S. *Challenger* brought Lieutenant Smith, R.N. to Port Louis as Governor, and he was given a force of some marines and sailors to support his authority. These men not long afterwards captured the principal murderer.

From 1833 to 1842 the Colony was in charge of the Naval Officers engaged in making the Admiralty surveys, but early in this latter year Colonel Moody took charge since which date there has been a civil administration.

EXPEDITION TO THE GULF OF CARPENTARIA.*

By J. P. THOMSON. LL.D., Hon. F.R.S.G.S., etc.

(WITH 27 PLATES).

At a Special Meeting of the Council of the Royal Geographical Society of Australasia, Queensland, held at the rooms of the Society, on Thursday, September 23rd, 1909, the following resolution, moved by the Vice-President, was unanimously adopted :—" Whereas, Mr. T. Graham, the Manager of Magoura Station, near Normanton, having reported that he had found certain marked trees on the eastern bank of the Bynoe River, at a spot about 22 miles S.W. from Normanton, and as there is every reason to believe that the trees were marked by the explorers, Burke and Wills, at their most Northern camp, No. 119, the Council resolve that the necessary steps should be taken by the Society to verify the trees and the position of the camp, and that to that end the Secretary, Dr. J. P. Thomson, as the person most qualified for the duty, be requested to proceed to Normanton at an early date, in order that the genuineness or otherwise of the discovery be definitely and surely determined ; (a) by critically examining and carefully photographing the trees ; (b) by determining the correct latitude of the site by stellar observations ; (c) by ascertaining the rise and fall of the tide in the Bynoe River ; (d) by photographs of the river and immediate locality of the site, and generally in such other ways as Dr. Thomson may consider necessary or advisable ; and that the expenses connected with the investigation be borne by the Society, with the help of such aid as may be afforded by the Government and by private subscription."

Acting in accordance with this resolution, preparations were speedily made for the expedition to the Gulf country, and with the active co-operation, and valuable assistance of the Vice-President, Mr. Geo. Phillips, and the Surveyor General, Mr. A. A. Spowers,

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* Read at Special General Meeting of the Royal Geographical Society of Australasia, Queensland, February 17th, 1910.

the necessary arrangements were soon completed, as it was very desirable that an early start should be made before the wet season set in. The instrumental equipment consisted of a Sextant, a Box Sextant, Mercurial Artificial Horizon, Aneroid Barometer, Prismatic Compass, Solar Black Bulb Thermometer, Fahr. Thermometer, one five chain steel band, a one chain steel band, and a Chesterman Metallic 66 ft. tape, one half-plate Camera by J. Lancaster & Son, Birmingham, with a Lichtner & Co. Rapid Rectilinear Lens, an Eastman, No. 3 A Folding Film Kodak, a liberal supply of plates and films, together with the necessary chemicals for developing same, all made up in packets ready for use. With everything packed up securely, a start was made from the Central Station by the Northern Mail train on Friday night the 1st October. On arrival at Gladstone the following day, I embarked on board the S.S. "Maranoa," and in the afternoon sailed for Townsville, via ports, the weather being delightfully fine with cloudless sky and gentle breeze.

The town of Gladstone, 328 miles north of Brisbane, is pleasantly situated at the mouth of Auckland Creek, on an elevated ridge overlooking the harbour, with good natural drainage, and high hills and ranges away in the background giving the place a picturesque setting. It is an important shipping port for extensive pastoral and mining areas, with a deep water harbour protected on the outside by Curtis Island, and forming one of the safest and most commodious harbours in Australia, "inferior only to Port Jackson and Hobart Town," according to Colonel Barney, who reported to the Government on the matter in July, 1847; and this view has more recently been confirmed by another authority, who considered that the harbour "of Port Curtis offers safe anchorage for 1,000 of the largest vessels afloat." It is certainly an excellent sea-port, and has recently figured very largely in Roman Catholic literature, in consequence of the remarkable theory postulated by Cardinal Moran, who claims for the Spanish Navigator, De Quiros, the honour of its discovery, in 1606, or more than one hundred and fifty years before Captain Cook. His Eminence's views upon so important a geographical discovery are altogether too extravagant for serious consideration, further than to remark that the physical and general local conditions of Port Curtis are such as to render any reasonable comparison with those of the Bay of Santo, in the New Hebrides, out of the question.

After leaving Gladstone, we steamed northerly along the picturesque shores of Central Queensland, and passing through the interesting Beverly Group, anchored off Flat Top Island, at the mouth of the Pioneer River, about half-past nine o'clock on the following morning. Here the first cocoanut palms were met with. Port Mackay is the

outlet of a fine pastoral and agricultural district, with extensive areas of rich alluvial soils in the bottom lands of the Pioneer River Valley, now occupied by numerous cane plantations, the locality being for many years the seat of an important sugar industry. Although lying within the tropics the mean shade temperature is only 73 degrees and the average annual rainfall but 75 inches.

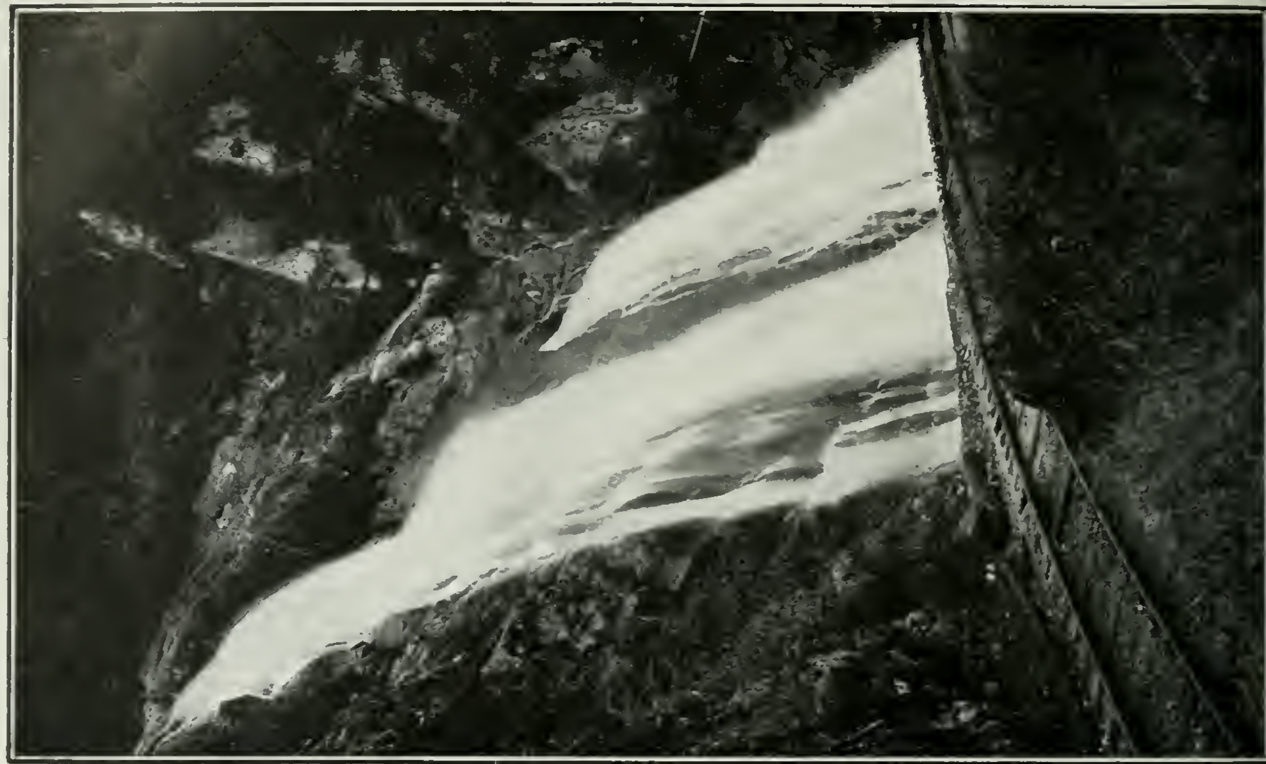
After leaving Flat Top Island the "Maranoa" steamed northerly hugging the coast line, and winding through the beautiful Whitsunday Passage, reached the pretty town of Bowen on Sunday afternoon. The whole population of the place seemed to be down on the jetty when the steamer arrived, both sexes having evidently turned out in holiday attire to do justice to the occasion. Bowen occupies an advantageous position on the shores of Port Denison, and is favourably situated as the outlet of an important agricultural and pastoral district, famous for its excellent fruits. The harbour is commodious, and affords splendid accommodation for all kinds of shipping. In point of fact, there are physical reasons why Port Denison should rank as one of the finest harbours on the Eastern coast of Australia. After landing the mails and passengers the "Maranoa" cast off from Bowen jetty and steamed away at full speed for Townsville, which was reached on the following morning at daybreak. Here the oversea and coastal vessels berth alongside the outer breakwater jetty, separated from the town by a long, dusty road across an uninteresting stretch of bare flat land, at the mouth of Ross Creek, which is probably one of the least imposing tidal streams at low water to be found near any of the important coastal towns of Northern Queensland. There can be little doubt that the material improvement of this area and its intersecting road of access would be greatly advantageous to the town, and contribute considerably to the convenience and personal comfort of visitors. Townsville, although a seaport of great importance and unlimited possibilities, is less favourably circumstanced, on account of its exposed position and physical disabilities than some of the natural harbours on the Pacific Coast line of the Australian Continent. Commercial enterprise and engineering skill combined, have, however, contributed to the extensive improvements of the inner harbour, by the construction of an immense breakwater at a heavy cost, and this is placed so as to afford ample accommodation and complete protection for coastal and oversea shipping of every description. Townsville may, therefore, be considered as the commercial capital of North Queensland, with ample resources and unlimited potentialities for development. At present, it is an important distributing centre for oversea imports, and the natural outlet of an extensive district, whose mineral areas

include the famous Charters Towers and Ravenswood goldfields, and the copper deposits of the Cloncurry region. It is also backed by vast pastoral and agricultural areas, including the fertile sugar lands of the Burdekin delta and large station properties, where the finest quality of wool is produced, and stock of every description raised annually in large numbers, while railroads stretch out from the town to Richmond, Cloncurry, Hughenden, Winton, and other important industrial centres. At Townsville the passengers and cargo for northern ports were transhipped into the S.S. "Kuranda," an up-to-date twin-screw steamer, which left, as usual, about 10 o'clock on Monday morning, or some five or six hours after the arrival of the "Maranoa." The run to Cairns, which was reached about noon on Tuesday, was accomplished in ideal weather without any remarkable incident or mishap. The intermediate ports of call included Lucinda Point, Cardwell and Geraldton, at the mouth of the Johnstone River. This part of the journey embraces the most interesting and picturesque section of the coast line, comprising the diversified beauties of the Hinchinbrook Passage and the lofty ranges in the neighbourhood of Bartle Frere and Bellenden Ker amongst the highest elevations in Australia. Favoured by a copious rainfall of over one hundred and forty inches, the Cardwell district and neighbourhood, extending North to Cairns and Port Douglas, is covered with dense tropical vegetation, in striking contrast to the other coastal districts of Queensland, the general appearance of the country very much resembling the jungle clad islands of Polynesia. The Johnstone and Mulgrave Rivers are the principal streams of this district, whose low lands are flanked by rugged ranges and precipitous mountains, clothed to the summits with forest and scrub. Large areas of the alluvial flats are under cultivation, and sugar cane is grown extensively, especially in the valley of the Johnstone, where important sugar industrial centres have long been established. The general aspect of the country is very beautiful, a succession of plains, hills, and mountains, marked with gorgeously tinted vegetation, whose ever-changing colours reveal themselves to perfection in the slanting rays of early morning sunlight, when the heavy dew-drops are dripping from the foliage, and with the cloud shadows passing over all.

The town of Cairns, located on the shores of Trinity Bay, occupies a site barely above sea level, and but for the protection afforded by the Great Barrier Reef would probably be rendered unhabitable by periodical invasions of the sea. As it is the place is absolutely secure, and seems to be one of the most prosperous seaport towns in the State, with every prospect of development as the main

BARRON GORGE, CAIRNS RAILWAY, NORTH QUEENSLAND.

BARRON FALLS, CAIRNS RAILWAY, NORTH QUEENSLAND.



STONY CREEK FALLS, CAIRNS RAILWAY, NORTH QUEENSLAND.

SURPRISE CREEK, CAIRNS RAILWAY, NORTH QUEENSLAND.

ST. PAUL'S GAP, NEWCASTLE RANGE.

SIX-HORSE MAIL COACH, CHARLESTON TO GEORGETOWN.

LAST OF THE BYNOE NATIVES, SHOWING BOTH SEXES.

LAST OF THE BYNOE NATIVES—WOMEN IN CAMP.

outlet of an extensive and most important mining and sugar-growing district. The streets are wide and shade trees were seen growing in some of the principal thoroughfares. It is the initial point of a railroad system extending to the Barron Falls at Kuranda, the Mulgrave, Mareeba, Atherton, Mt. Garnet, Chillagoe, and Etheridge goldfields. The climate is moderately tropical in the town, but a rapid cool change is experienced on the edge of the Herberton Tableland at Kuranda, a two hours' journey by train. The rich soils of the coastal belt are rendered extremely fertile in the neighbourhood of Cairns by a bountiful rainfall of 77 inches. The land in the neighbourhood of the town, and extending as far as the Barron River, and up the slopes of the foot hills Westerly and Northerly, is under cultivation, the whole being laid out into comparatively small plantations, mostly in the hands of Chinamen, who supply the market with a variety of fruits and vegetables unprocurable from any other source. Indeed, there seems to be little doubt that in the agricultural industry of the State, the celestial settlers would have no difficulty in establishing their claim as being at least among the earliest pioneers. Anyway, their carefully cultivated plantations lend beauty and animation to the scenic attractions of the locality, and at the same time serve a very useful and, in point of fact, indispensable purpose in the economy of pioneering life.

From Cairns I travelled overland to Normanton by rail and coach, most of the journey being over interesting though extremely dry country. The railroad as far as Mareeba Junction is the property of the Government, but from there on to Almaden Junction, and right across the Etheridge Gold Field to Charleston, it is owned and operated by the Chillagoe Company. At the time of my visit the line was, however, only open to traffic as far as Reedy Springs, about fifteen miles from Charleston, the journey thence to Croydon, via Georgetown, being by coach across country for probably 135 miles. One distinctive feature of the private railroad is noticeable in the absence of elevated platforms at the various stations and sidings along the line, which corresponds with the American system, and is probably well adapted to existing conditions of settlement in a comparatively new country. With the exception of a few widely scattered mining centres, the whole of the territory under consideration is unsettled, its present accessibility and much of its development being due to the enterprise of the Chillagoe Company, whose extensive operations in opening up a vast wilderness to industrial occupation is an object lesson to the public of Queensland, and a monumental example of the immense advantages derived to the country at large by well directed private effort. The first stage of my overland journey

from Cairns to Normanton embraced the Barron Falls and Gorge, the former being very disappointing on account of the comparatively small volume of water in the River, long stretches of the Channel above and below the falls being quite dry, in the absence of much needed rain, a condition only too apparent over the whole of this Northern part of the State. The Barron Falls are responsible for much good, bad, and indifferent local literature, descriptive of their scenic beauties under conditions as varied as are the authors themselves. In most cases the descriptions are ridiculously extravagant. Even when the Barron River is in full flood the Falls can bear no possible comparison with any of the world's greatest cataracts. On the other hand, the Barron Gorge, and associated physical features below the Falls are most impressive in their natural beauty, which is probably unsurpassed in any other part of the world. I have traversed the famous Royal Gorge and the Grand Canyon of the Colorado region, have passed through the rugged and precipitous defiles of the Drachenbergs, and the profound chasms of the New Zealand ranges, but to my mind they are not so attractive in point of natural beauty as the Barron Gorge, whose beautifully tinted mantle of rich tropical vegetation imparts to the rugged landscape a charmingly animated appearance, lovely to the eye and seductive to the senses. The railroad hugs the edge of this Gorge, so that the physical structure of the country, the details of the landscape, and the panorama spread out to the astonished gaze of the traveller, may be studied with great advantage from the carriage platform or window. In a long, wide, and varied experience all over the world, nothing similar seems to have impressed me so much as the Barron Gorge and locality, so much so that I felt half inclined to give expression to my feelings in the words of a famous author who must have been brought face to face with a similar nature picture when he wrote :—

> "So wondrous bright the whole would seem,
> The scenery of a fairy dream."

To my mind, as a disinterested observer, it would be more desirable in tourist's literature to emphasise the beauty and attractiveness of the Barron Gorge in preference to the Falls, which according to the natural order of things must always vary very greatly in volume, and consequently in general appearance. This would disarm criticism, and leave no room for disappointment on the part of tourists who might probably visit the locality, as I happened to do when the Falls bore little resemblance to their pictorial representations.

Geographically considered, the whole of the country from Kuranda, at the head of the Barron Gorge, to Croydon, is what may

be described in general terms as an extensive undulating tableland, whose elevation above sea-level varies from 1,000 to 2,400 or 3,000 feet. In places where the area is intersected or traversed by such features as the Newcastle Range, the Gregory Range, the Featherbed Range, and other unimportant topographical representations, the variations in elevation are comparatively slight, and probably rarely exceed a few hundred feet above or below the general surface level, which, extending over a large area of country, is barely perceptible. These local physiographical conditions mainly contribute to the extreme dryness of the atmospheric air, and the comparative coolness of the climate on the whole. It is true that the vertical rays of the summer sun greatly intensify the general heat of the season, and render outdoor life less agreeable than during the cooler months of the year, but there is a modifying influence exercised by the excessive dryness of the climate. The sky is generally cloudless, the radiation after sunset is consequently great, the temperature falls rapidly, and the nights are usually cool. The winter climate is said to be perfect.

On the whole the country is poorly and lightly timbered with scattered and stunted forest trees. There is consequently very little shade, and the glare from the sun baked surface of the ground is usually uncomfortable to the unprotected eyes.

The geological structure of the territory indicates an extensive development of the Palæozoic formation, in which the granites predominate, and this is associated with comparatively narrow belts of basaltic and other igneous rocks. The known mineral areas are both rich and extensive, being widely distributed over the whole of the country, but there are other vast tracts still awaiting examination by the pioneer prospector, notwithstanding the numerous goldfields along the railway lines and elsewhere. The soils vary considerably in distribution, quality, and composition. In most places they are rich, and only require an adequate water supply to render them extremely fertile. There are, however, patches of country where the soil is poor, and barely capable of sustaining a scanty vegetation. This is particularly noticeable in what is known locally as the tea tree belt, where the white clayey soil is met with, and on the ironstone ridges, where the timbers are stunted and poorly nourished. The country is infested with white ants, by which every thing and place are invaded—telegraph poles, railway sleepers, houses, fences, forest trees, and the surface soils bear striking evidence of their depredations in all directions. Indeed, there seems to be far more termites' nests to the square acre than trees, and this holds good all over the country. Generally speaking, the nests are not large, being usually

from one to three feet high, and thickly dotted over the whole surface of the ground, like spring mushrooms. Occasionally some remarkably large examples are met with, but these are not numerous.

At present this northern part of the State is given up to pastoral and mineral occupation, large interests of the former industry being widely distributed over the whole territory. But there is no dairy farming, no local milk and butter supply, these indispensable commodities being either imported or derived from domestic goats which are numerous at most settlements. This seemed incomprehensible in a country where cattle raising is the principal industry of enterprising pioneers. Although agriculture has not yet been attempted there can be little doubt that with irrigation, or an adequate system of water conservation, large areas could be profitably cultivated, and thereby be made to contribute materially to the welfare of the people, and the revenue of the State at large. This is indeed an industry which should be encouraged in these parts as much as possible, for although there are abundant indications everywhere that the mineral wealth of the country is unlimited and practically inexhaustible, it ought to be borne in mind that it is the farmer, the man who cultivates the soil or grows sheep or cattle, upon whom the permanent future industrial and agricultural welfare of the State must depend. Viewed in this light, in the light of experience and progressive human knowledge, I feel confident that there is a great future for Northern Queensland. The country is easily accessible in all directions. The whole way from Mareeba Junction to Charleston the railway line traverses a comparatively flat tract free from any formidable physical obstacles, and stations have been erected at convenient places where local settlement exists. The accommodation for travellers and goods traffic provided by the Chillagoe Company over their lines is more than is necessary at the present time. In this respect, it may be said, that the railways have been built to develop the country, and not because the country was in need of the railways, and this should be the policy in every undeveloped country where settlement is needed.

A trial line for a projected railroad has been surveyed between Georgetown and Croydon, over a comparatively flat country, and the permanent way will no doubt be constructed in due course, when the former town will be linked up with Normanton, and on completing the railway connection with Charleston there will be direct railroad communication between the Gulf of Carpentaria and Cairns. This, to my mind, is essential to the development of the country, and ought not to be delayed any longer than is absolutely necessary. The unconnected sections are comparatively short and free from

physical obstacles, with the exception of one or two shallow river channels, mostly dry during the greater part of the year. Indeed, at the Gilbert Telegraph Station, the river bed where the coach crossed, was found to be a broad stretch of dry hot sand, and this was characteristic of all the watercourses met with between Cairns and Normanton

The town of Croydon is the administrative centre of important mining interests, and until lately was one of the largest gold producing areas in the State. It is 94 miles from the seaport town of Normanton, and situated in the very heart of a rich mineral and pastoral district. At the time of my visit some of the mining plant was out of commission, but indications were not altogether wanting to inspire the hope that Croydon will soon resume its former position, as one of the most active mining centres in the State. The site of the town is favourable both from geographical and climatic considerations, the streets being wide and well laid out, the drainage natural, and the elevation considerable. The railway line to Normanton traverses for the greater part of the way a low-level sparsely timbered plain, much of it being liable to flood in the wet season. The decrease in level from Croydon is gradual, and the rails are placed near the natural surface of the ground on a slightly raised roadway. By some happy professional inspiration steel sleepers are laid down over the greater portion of the line, their superiority over the wooden sleepers being apparent to the most casual observer. Combined with the steel rails, they are about the only material used in the construction of the line to resist the attacks of the white ants, and this is a very important consideration in a remote part of the country where suitable timbers are not plentiful.

On arrival at Normanton, I was met by Mr. A. V. Allom, the courteous local Manager for Messrs. Burns, Philp and Co., and Mr. Whittaker of Magoura Station, who kindly represented Mr. Graham, the Station Manager, unavoidably absent at the time with the Pastoral Manager in some remote part of the run. The town of Normanton, it may here be remarked, is situated on the left bank of the Norman River, about 80 miles from its mouth, on the shores of the Carpentarian Gulf. It is built on a slightly elevated site along the slopes of an ironstone ridge, having natural drainage, and the streets are wide, well laid out, and regularly formed. There is good wharfage accommodation on the river bank, and communication with the sea is by steam tender. The tidal influence extends for some distance above the town, but the tide rises and falls only once in the twenty-four hours, this phenomenon being similar along all the shores of the Gulf. The surrounding country is poorly timbered, low lying, and subject to inundation when the neighbouring rivers overflow

their banks in the rainy season, and there is scarcity of water in times of drought, a condition by no means peculiar to this locality, for then water is unhappily scarce over most of the northern territory under reference. Owing to the poor quality of the soil, being chiefly of a sandy nature, the land is mostly utilised for pastoral purposes, being hardly suitable for agriculture, its carrying capacity being from fifteen to thirty cattle to the square mile, and this estimate may be said to hold good for the whole of the Gulf country. After a couple of hours delay in Normanton, I proceeded to Magoura Station by buggy, in charge of Mr. Whittaker, to whom I feel under obligation for subsequent valuable assistance.

Magoura is situated on a slightly elevated ironstone ridge about 18 miles south-west from the town of Normanton, and commands fairly extensive views of the surrounding country, mostly consisting of immense open grassy plains, with alternating narrow belts of stunted timber. On the following morning, I drove out to the Bynoe River, to make a preliminary inspection of the marked trees discovered by Mr. Thos. Graham, and supposed to indicate Burke and Wills' most northerly camp, known as No 119. The trees were found to be located on the right bank of the Bynoe River, about 7 or 8 miles in a south-westerly direction from Magoura Station, and at the junction of a creek or a branch of the River. It may here be convenient to remark that the Burke and Wills expedition, which left Melbourne in 1860, to cross the Continent from South to North, succeeded in reaching a point within the influence of the tidal waters of the Gulf of Carpentaria. The identity of this point has always been in doubt. King, the sole survivor of the ill-fated expedition, said that Wills, the surveyor, believed the explorers were on the Albert River. This was discredited by the late Baron Sir F. von Mueller, who, having examined Wills' notes and observations, gave it as his opinion that it was the Flinders River, which is over 70 miles to the East of the former. In expressing this view, it must be remembered that Baron von Mueller was speaking from personal local knowledge, having as an officer of Gregory's North Australian expedition, traversed and explored the Gulf territory, and was therefore familiar with the rivers and other geographical features of the country.

In his evidence before the Commission appointed by the Governor of Victoria, to inquire into and report on the circumstances associated with the sufferings and death of Robert O'Hara Burke and William John Wills, the Victorian Explorers, King said, that at Camp 119, situated on the Eastern bank of a tidal river, " There were some small box trees. We cut the bark eighteen inches by four, and cut the letter B on the trees ; some fifteen trees were marked, but with

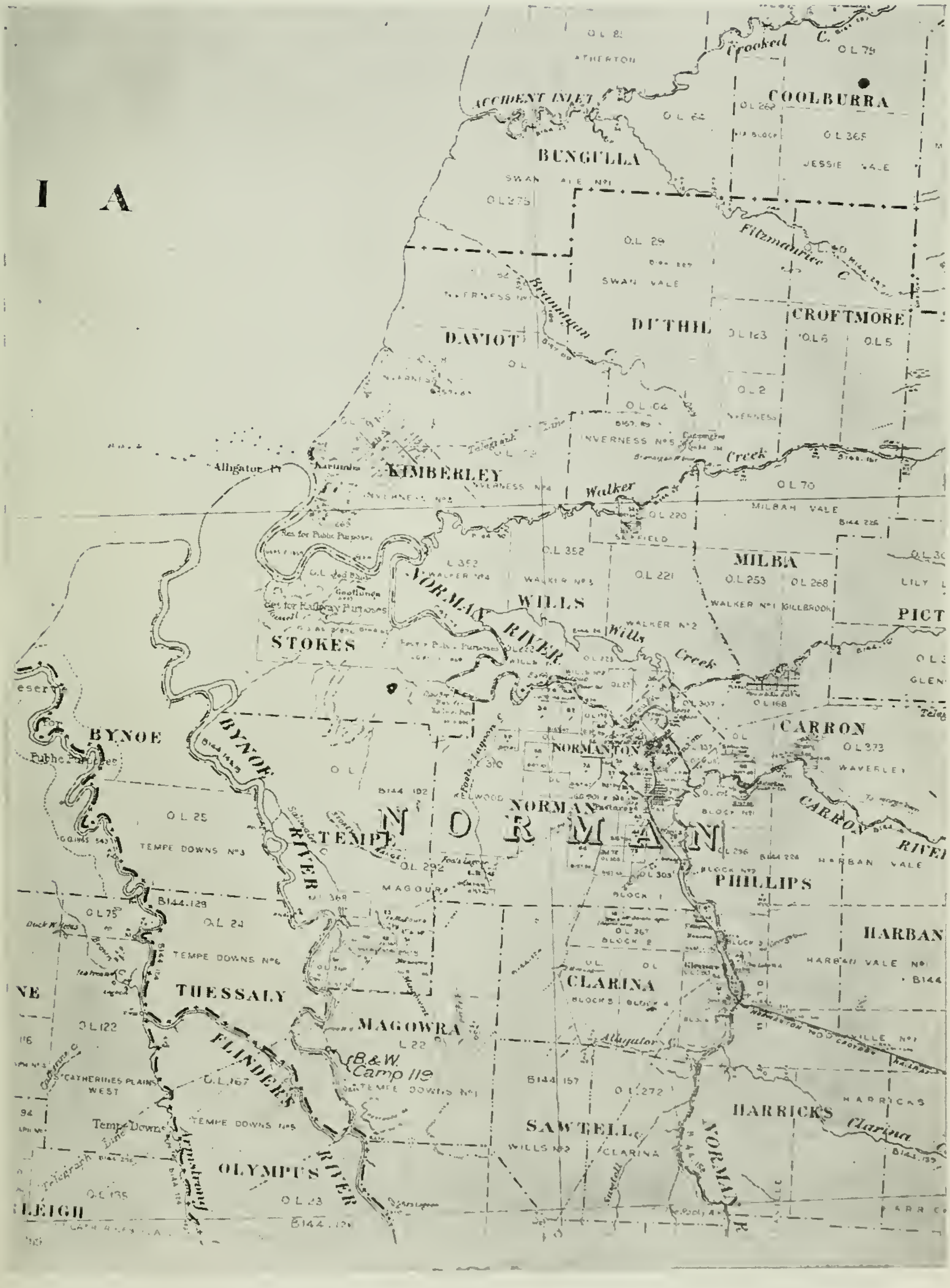
no date." Under the impression that the Expedition was on the Albert River, King, in answer to a former question, No. 812, stated, inter alia: "It was quite impossible for us to make the sea on the East side (of the Albert River) as the country was all under water; had we crossed the river and gone to the West side, there would have been no difficulty in reaching the sea; but as our provisions were then getting so exhausted, we were unable to do so. Mr. Burke thought he had quite fulfilled his task; we had the tide flowing, rising and falling to the extent of eight inches, and the water was quite salty." And further, in answering question 832: "There were some rocks in the bed of the river; on the East side there was some large rocks in the water, and we could see that those rocks were covered when the tide was up, and when it went down we could see the rocks."

In Mr. Wills' journal, Field Book, No. 9, it is stated: "Sunday, February 1st, 1861.—Finding the ground in such a state from the heavy falls of rain that the camels could scarcely be got along, it was decided to leave them at Camp 119, and for Mr. Burke and I to proceed towards the sea on foot. After breakfast we accordingly started, taking with us the horse and three days' provisions. Our difficulty was in crossing Billy's Creek, which we had to do where it enters the river, a few hundred yards below the camp. In getting the horse in here he got bogged in a quicksand bank so deeply as to be unable to stir, and we only succeeding in extracting him by undermining him on the Creek's side, and then lunging him into the water. Having got all the things in safety we continued down the river bank, which bent about from East to West, but kept a general North course. A great deal of the land was so soft and rotten that the horse, with only a saddle and about 25 lbs. on his back, could scarcely walk over it. Finding that the river was bending about so much that we were making very little progress in a Northerly direction, we struck off due North, and soon came on some tableland, where the soil is shallow and gravelly, and clothed with box and swamp gums. Patches of the land was very boggy, but the main portion was sound enough; beyond this we came on an open plain, covered with water up to one's ankles."

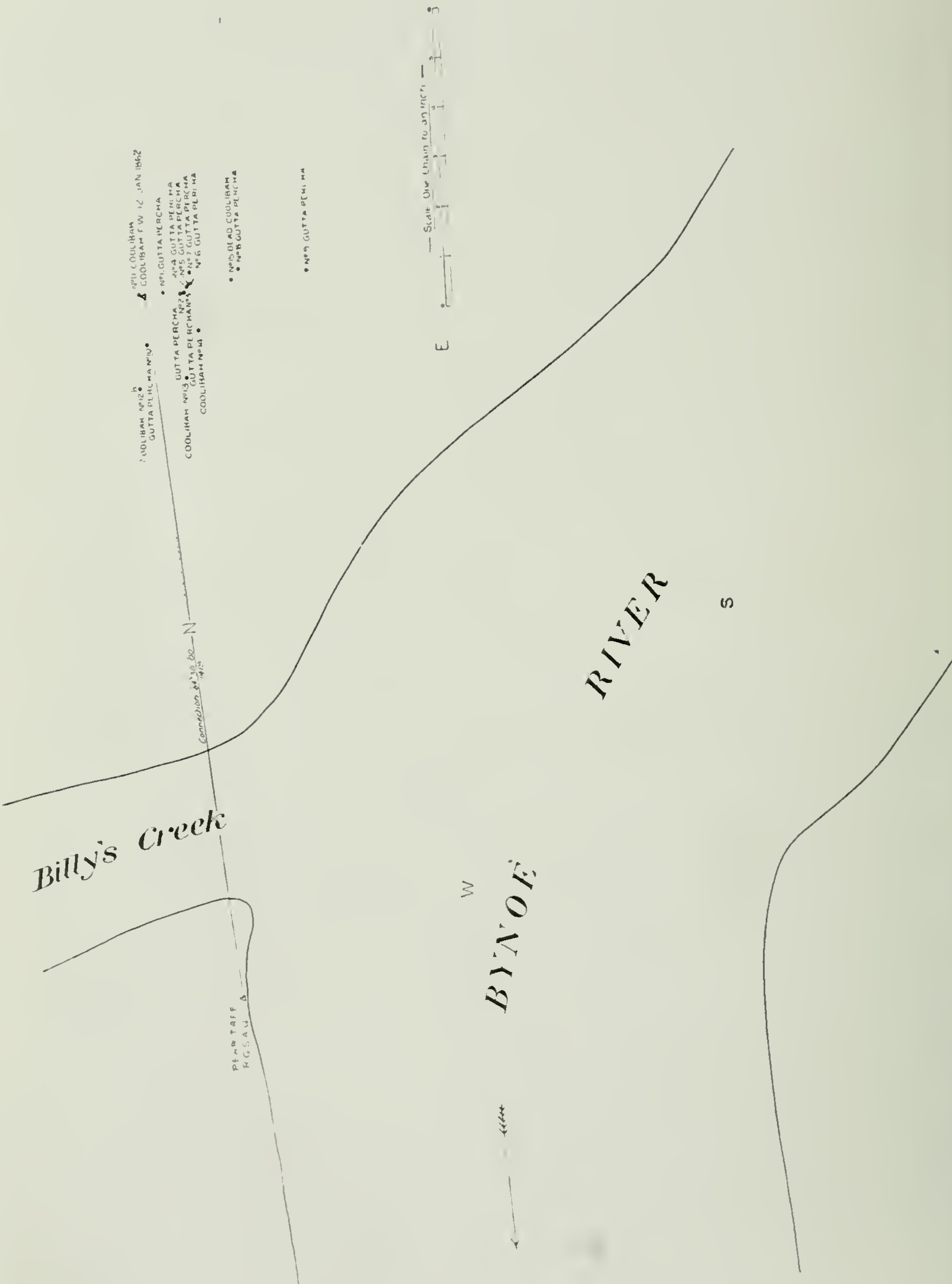
After an absence of three days Burke and Wills returned to Camp 119, on the 12th February, having been fifteen miles farther North, but "could not get a view of the open ocean," although within the influence of its tidal waters. They were as a matter of fact about 10 miles from the sea-shore when they turned back to Camp 119, but had apparently not marked any trees or left any permanent record behind them to indicate their position or the point they had reached. King in his evidence, said they "took no knives or implements to do so."

From the foregoing remarks it will be understood that the identification of Camp 119 becomes necessary to settle the doubt which had arisen at the time as to whether the explorers were on the Albert River or the Flinders River For this purpose the available evidence afforded by marked trees and local geographical conditions, must be considered as well as the information supplied by Mr. Frederick Walker, the leader of an expedition from Rockhampton to the Gulf of Carpentaria in search of Burke and Wills. On striking the Flinders River near its junction with the Bynoe, thought at the time to be the Norman, Walker found the well-defined tracks of four of Burke's camels and a horse, coming down the stream, and afterwards going back in the opposite direction. He then pushed on Westerly to the Albert River to meet the relief steamer—Captain Norman—and on returning to the Bynoe other traces of Burke were found, and a tree marked B. CXIX was also discovered, and another branded S.S.E. 14 was picked up at a place farther South. Walker at first thought the former was Burke's 119th Camp, but the floods and young grass had probably obliterated the camel trails, and no further traces were met with, on renewing the search from the latter tree, the letters on which he fancied meant, " to dig fourteen feet south-south-east of the tree. They tried this, but the ground was hard, and had evidently never been opened before. The explanation probably was that it was either the fourteenth day or camp of the south-south-eastern route followed on their return." He had, however, previously come across boot marks with naked feet following, which was no doubt evidence of the blacks having stealthily followed Burke and Wills when they made their three days' foot journey North from Camp 119, endeavouring unsuccessfully to reach the sea. From the 5th till the 20th January, Walker continued the search, moving up along the Eastern side of the Bynoe and Flinders Rivers, but without success ; Burke's donwward tracks being all that could be seen, but no indications of the return. It was then decided to make for the Norman River, as no good purpose could be served by following up the Flinders, and so Walker disappeared from the locality, being the only white man who had found traces of the ill-fated Victorian Explorers in the Gulf country, but having singularly failed to establish the identity of their most northern camp, 119. Having thus briefly alluded to the localisation of Burke and Wills, it may perhaps be permissible to offer some remarks concerning my own investigations in locating the position of the marked trees on the Eastern bank of the Bynoe River, in accordance with my instructions.

On first inspection, the most noticeable feature of the locality was a Coolibah tree, marked " F.W., 12th January, 1862." This



MAP SHOWING RELATIVE POSITION OF BURKE AND WILLS' CAMP, NO. 119, BYNOE RIVER.



PLAN SHOWING RELATIVE POSITION OF MARKED TREES, BYNOE RIVER.

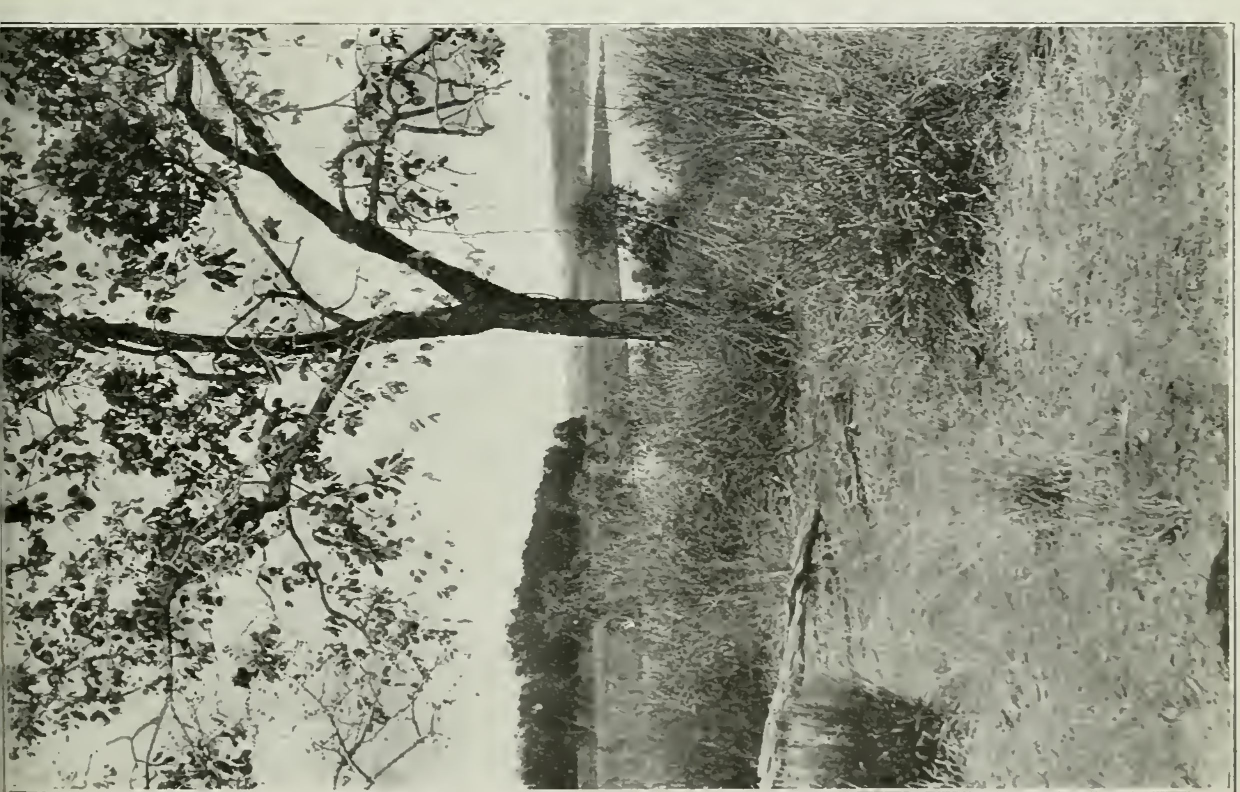
SECTION OF TREE MARKED BY F. WALKER, SHOWING THE MARKS, AT CAMP ON THE BYNOE RIVER.

TREE MARKED BY F. WALKER AT CAMP ON THE BYNOE RIVER.

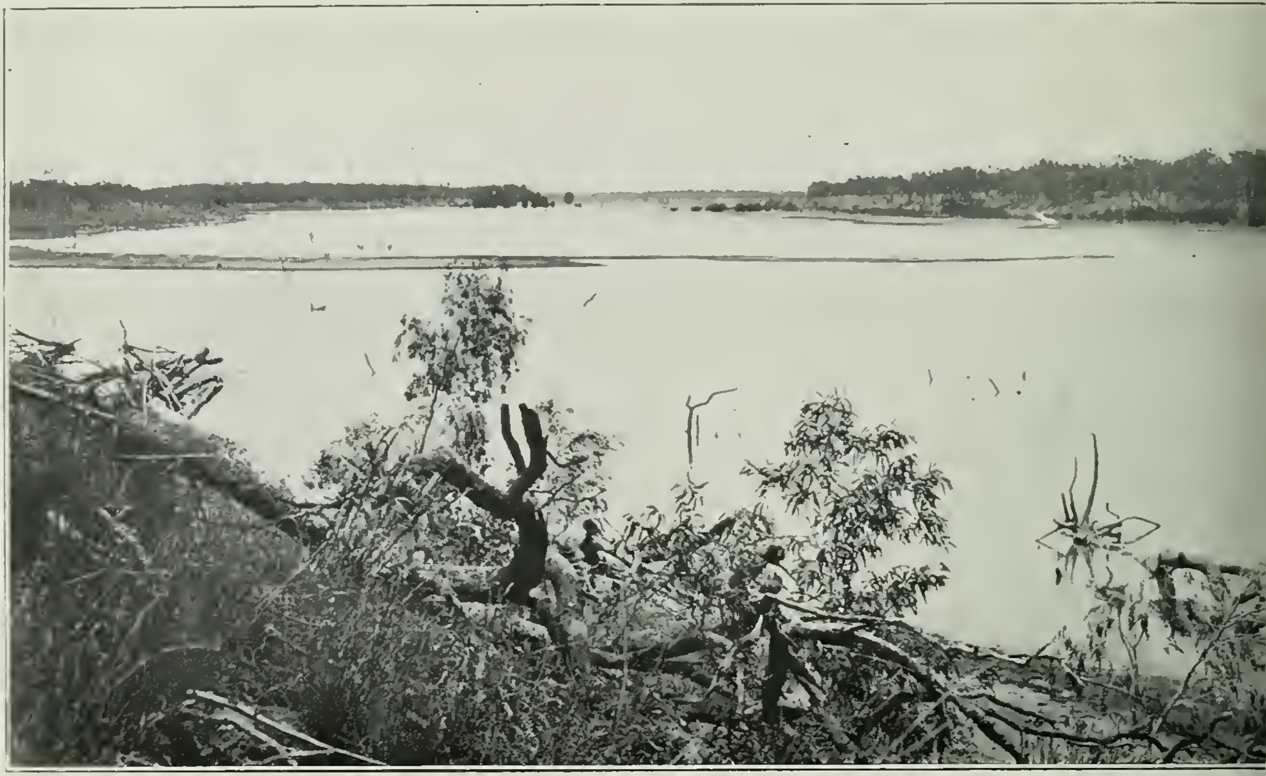
TREE MARKED "B," AT CAMP ON THE BYNOE RIVER.

SECTION OF TREE MARKED "B"—SHOWING THE MARK—BYNOE RIVER.

BILLY'S CREEK, BYNOE RIVER.



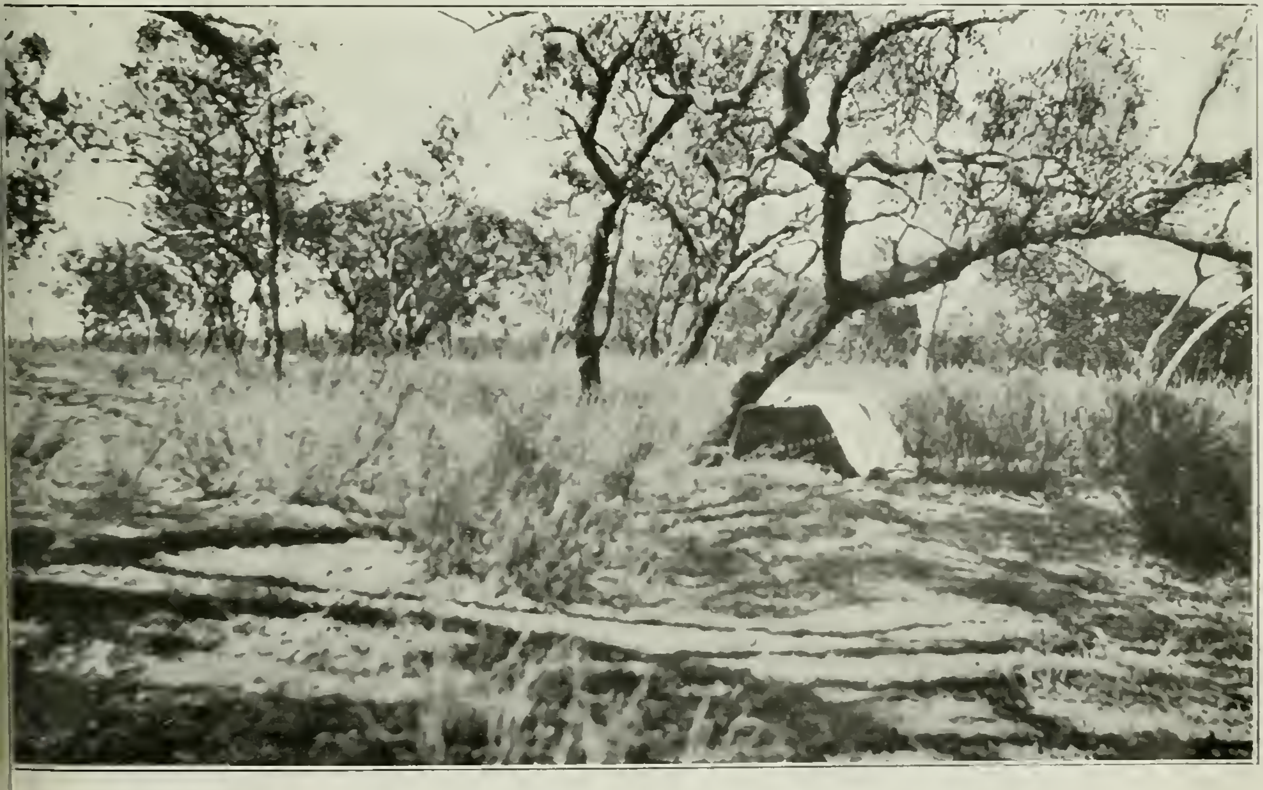
PEAR TREE MARKED R.G.S.A.Q., JUNCTION OF BILLY'S CREEK AND BYNOE RIVER.



BYNOE RIVER, LOOKING UP STREAM FROM CAMP.

BYNOE RIVER, LOOKING DOWN STREAM FROM CAMP.

CAMP, BYNOE RIVER—GENERAL VIEW.



PHOTOGRAPHIC "DARK ROOM," AT CAMP ON BYNOE RIVER.

MAGOURA HOUSE PARTY AT CAMP ON THE BYNOE RIVER.

CAMP ON THE BYNOE RIVER.

inscription had been deeply and clearly chiselled on a shield cut out of the side of the tree facing the East, and was grown over except the letter F. and the figure 8, which were quite exposed, but perfectly sound, and showing only the slightest signs of weathering, the whole being the work of a skilful hand, and of great interest from its original associations and extreme remoteness. Mr. Thos. Graham, who discovered the marked trees, had cut out the overgrown portion of the shield before my arrival, so that I merely had to clear out the particles of decayed wood along the original chisel marks before taking a photograph. This tree, which is comparatively small, being only 3 feet 5 inches in girth, was marked by Walker, and doubtless indicates the place where he found Burke and Wills tree marked B CXIX at a spot which we now know to be identical with Camp 119. Its position is 84° 30′ by compass, and distant 14 chains 19 links from a pear tree marked R.G.S.A.Q. on the lower side of Billy's Creek, where it joins the Bynoe River. Besides Walker's trees, fifteen trees were found to be marked at this camp, and in most cases the marks were facing the East. Five of these were Coolibah trees, one being dead, and the other ten are Guttapercha trees, the whole being small and not exceeding three feet in girth. The latter variety is, however, a very slow grower, and nowhere in the locality was it found to attain to any large dimensions. The former also grows slowly, but several comparatively large specimens were scattered about in the camp and immediate neighbourhood, and one could not help wondering why the smaller trees had been selected in preference for marking. Contrary to what might have been expected from a hurried glimpse of the locality, the timber growths were sparse and stunted, showing but slight indications of tropical vigour. On a close inspection, it was, however, seen that the soil was chiefly of a white clayey substance, and apparently not at all rich in its component parts, the sub-soil being a stiff and highly tenacious clay. On the Western side of Billy's Creek, and extending down along the right bank of the Bynoe River, there seemed to be a much better quality of timber, the trees being larger and taller. The Guttapercha is apparently not only an extremely slow growing tree, but comparatively soft, the wood not being durable when cut. Back from the river and tributary creeks, the country mostly consists of extensive open plains interspersed with belts of timber and slightly elevated ridges, the flat areas being usually flooded during the rainy season. The area at the junction of Billy's Creek with the Bynoe River is, however, slightly higher than its environment, and admirably adapted for camping purposes, the waterholes in the Creek abounding with an interesting variety of wild duck.

The first examination of the fifteen marked trees was not too encouraging, beyond the apparent fact that the original marks had been cut with an axe or other sharp edged tool, traces of which were still visible on close inspection. Each tree having been carefully examined, the overgrowth was cut away from the old mark, but with one exception the results were negative, it being evident that all traces of probable original inscriptions had long since disappeared from the soft and but slightly durable Guttapercha wood. The exception proved to be a Coolibah, bearing by compass 274° 30′, and distant one chain eighty-five and a half links from Walker's tree. A critical examination of the old mark on the Eastern side of this Coolibah, revealed the rather faint but clearly traceable outlines of the block letter B. This happy discovery seemed to have a vitalising effect on the investigations of the Expedition, stimulating individual effort to the highest pitch, and creating enthusiasm when least expected. Unlike the original marks on all the other trees, the shield cut out of the Coolibah was only slightly overgrown, so that most of its surface had been left fully exposed to the wind and weather of a severe tropical climate for fully 48 years. After all this lapse of time, it is only reasonable to suppose that an inscription which had, perhaps, been originally, but very superficially chiselled, would have suffered materially, and probably have disappeared in whole or in part.

While King in his evidence stated that the letter B. was cut into some fifteen trees at Camp 119, no date and presumably no other marks, Walker found a tree at what he at first fancied to be the same place marked B. CXIX, being the more likely inscription for the Explorers to have left behind them, at what was practically the objective point of their overland journey. Should this view be correct, and it is entirely borne out by the history of Australian exploration, then we are justified in assuming that the latter part of the inscription (CXIX), probably not quite so deeply cut as the former, must have naturally disappeared from the Coolibah tree. And I have no doubt whatever this is what actually occurred.

The whole of the trees having been photographed in groups or singly, as circumstances suggested, the geographical conditions of the locality were fully investigated, it having been found more convenient to camp on the ground till the work was finished. Carried out as it was at high pressure in the shortest possible space of time, under the most rigorous climatic conditions, being fully and continuously exposed to the maximum intensity of heat and light, the photographic work, it is gratifying to note, was very satisfactory. This, however, was only accomplished after much trouble and

experiment. The task of changing the plates in the daytime was very disagreeable and sometimes distressing. For this purpose a dark enclosed space had to be improvised in the shape of an old packing case, covered with several layers of woollen rugs and other heavy material, the sunlight being so intense. The plates were developed at Magoura Head Station, where an old empty iron water tank took the place of the camp packing case. But even under the improved auspices of the Station the conditions were unfavourable for work of the kind, there being usually experienced a strong hot wind charged with minute particles of dust, which settled on the films, and the intensity of light and heat was a constant menace to success.

On exploring the environs of the camp the physical conditions were found to correspond with King's description of the locality. There is an outcrop of rocks in the bed of the river on the East side and in the water, a little above the camp, and the water was quite salty. The tidal movement was, however, barely perceptible. But there is probably an appreciable rise and fall, synchronizing with the maximum and minimum lunar phases, especially when the strong northerly winds are blowing or during the rainy season, when the river is running, and the channel freer from obstruction. At the time of my visit the country was suffering from drought, most of the rivers were comparatively dry, and the Bynoe was very low, there being no strong influence from the North to force the tidal water of the Gulf up its snag-studded channel. It must, of course, be considered that material physical changes have occurred in the bed of the river since Burke and Wills' time, there being abundant indications that the carrying capacity of the channel has decreased by the ever-increasing deposition of silt, and the erosion of the banks, which would have a retarding influence on the tidal waters. And similar changes have been going on in Billy's Creek, especially at its mouth, where a large deposit of silt has accumulated, forming a bar of heavy, soft, clayey soil, which blocks out the waters of the Bynoe, and cuts off the creek when both are low. This is no doubt the identical spot where Burke and Wills had their horse "Billy" bogged, as here the natural conditions would be eminently favourable for such an occurrence, especially in the rainy season, when the place would be little better than a quicksand. At the time of my visit the surface of the deposit was sun-baked, and hard enough to be crossed, but from the trail of crocodiles and other indications, it was evidently treacherous ground when submerged. The Bynoe, to all appearances, is really the main channel of the Flinders River, and was first surveyed by Mr. George Phillips, Vice-President of the Society,

who, in 1867 made a boat traverse of the channel from the mouth to within a short distance of Billy's Creek. Above the first 20 miles, the banks of the stream are bold and in places, the channel is obstructed by snags. The volume of water carried by the stream when in flood must be immense, and the sediment brought down enormous, as indicated by the marks along the banks and the silting up of the channel. It is perhaps not generally known that the Flinders River is one of the largest streams in Australia, its length being some 500 miles, and drainage area over 47,000 square miles, including tributaries. At the time Burke and Wills camped on the Bynoe the heavy monsoonal rains had set in, and the river was probably in flood when the Explorers left the locality on the return journey, as in the following year Walker found flood marks eighty feet above the ordinary level of the waters. In pursuing their journey northwards for about fifteen miles from Camp 119, Burke and Wills reached some high ground near the river. This was no doubt the Western end of the Stokes Range, whose position corresponds fairly well with the approximate distance from the Camp at Billy's Creek. Many blacks were seen by the Explorers, and it was noticed that wild yams were very plentiful in the locality. These latter are still to be met with along the river banks, and although the blacks have now dwindled down to a miserable straggling remnant, they were numerous and aggressive enough to give Walker a good deal of trouble forty-eight years ago. Before leaving the locality several stellar observations were obtained, by which the position of the camp was found to be in 17° 53′ South Latitude. This agrees with the position given by Burke and Wills. Taking therefore into consideration the sum of the foregoing conditions, it seems to me there is no reason to doubt, but that this is identical with the ill-fated Victorian Explorers' camp 119, and that its identity would have been established from the very first had Walker made the necessary astronomical observations when on the spot. He did not, however, know the circumstances and conditions surrounding the camp, much having to be left to conjecture, and this may be accepted as an excuse for the absence of more definite information on his part at the time. And mention may now be made of the fact that the existence of the marked trees at this camp was quite unknown to the oldest settlers of the Gulf, and their discovery came as a great surprise to them.

Having accomplished the work entrusted to me by the Council of our Society, nothing further remained to be done but to break up camp and prepare for the return journey. Before leaving the locality the camp was visited by a house party from Magoura, including the genial host and hostess, with their children, who animated the

scene and enlivened the last hours spent on the site occupied by the ill-fated Burke and Wills half a century ago. A couple of days were spent in Normanton, and the first stage in the homeward journey was traversed in the mail tender "Dugong," from the Norman Wharf to the mouth of the River at Karumba, some eighty miles or thereabouts, including the distance over the bar where the mail steamer was boarded. An interesting feature met with at the mouth of the river was an original native camp occupied by the last remnant of the Karumba tribe, including both sexes in childhood and old age. The chief wore an ornate brass plate, between which and the children his attention seemed to be equally divided. The camp was on a fully exposed, barren spot, and the gunyahs, which were circular and quite open at the top, had a most unattractive and primitive appearance. The occupants, however, seemed to be well nourished and healthy, and some of the younger females, no doubt, wishing to add to their natural attractiveness, dressed themselves with European blouses and skirts when preparing to line themselves up in front of the camera, although they were told that this was not necessary, or even desirable.

The Gulf country is under pastoral occupation, for which it seems eminently adapted, the immense grassy, open plains, and lightly timbered belts being ideal pasture land, capable of raising millions of cattle for the markets of the world. One of the most urgent needs of the present day appears to be railway communication from deep water at Karumba to Normanton, Cloncurry, Burketown, Camooweal, and the rich mineral areas of the Leichhardt district, for which the people are striving, and the linking up of the Croydon and Etheridge lines through Georgetown. While these will no doubt come in time as the country gets more settled, and industrial life develops, it would serve the best interests of all concerned and the State at large were the matter to receive attention with as little delay as possible. Already an area of 30,000 square miles of the district has been inspected by Mr. George Phillips, C.E., whose valuable report thereon forms an interesting and welcome addition to the official professional literature of the State.

It may here be noted that the origin of this Gulf territory is suggested by the plentiful occurrence of fossiliferous deposits of ancient marine life over a large extent of the country, remote from tidal influence. In its present condition animal life is numerous, birds especially being met with in great variety, while the rivers and tidal channels are mostly infested with crocodiles of forbidding appearance and enormous proportions.

The run up the Gulf was pleasant and unattended with any notable incident, the first point of interest met with being Booby Island, at one time the Torres Strait Port Office, the repository of an interesting Log Book, and other historical memoranda now gone, no one apparently knowing where. At Thursday Island one's attention is at once arrested by the diversity of racial types met with on first landing on the coral bound shores of that commercial centre of the pearl industry, and other absorbing interests. The Southern side of the Island is occupied by the business and residential quarters of the mixed community, and at the extreme South-Western end the Government residency is located on a point commanding a view of three-quarters of the compass, the place being an ideal look-out, and admirably adapted for its special purpose. At the back of the town on the summit of the ridges forming the centre of the island the fortifications occupy a dominating position, with an unobstructed range in all directions. On a slightly lower spur of the main ridge there stands the grave of the former Government Resident, who as one of the first Hon. Members of our Society, was a greatly valued contributor to its literature, an able administrator, and an accomplished public speaker—the Hon. John Douglas. A little way back from the beach, in a pleasant position, is the Quetta Memorial Church, erected in commemoration of the ill-fated mail and passenger steamer "Quetta," wrecked in Torres Strait on the homeward bound voyage from Brisbane to London, in 1890. With other interesting relics, the bell of the vessel was afterwards recovered, and is now suspended from a detached wooden framework in front of the place.

The business life of the island seemed to be animated and prosperous, and although industrial activity is not what it used to be in former times when the harbour was the home of a large pearling fleet, the town showed no outward and visible signs of decline. Although the strategical position of the place is now well recognised by military experts, its great value to the Commonwealth as a naval station is, perhaps, not so generally understood or appreciated, notwithstanding its important geographical situation as the gateway of the great maritime trade route through Torres Strait to the East.

On leaving the harbour for the South, it was necessary to steam round the opposite side of the island on account of the exceptionally low tide in the early morning. The weather was calm and the sea as smooth as glass, there being little change all the way down the coast. We passed close to Cape York, the most northerly point of the Continent, and steamed under ideal conditions through Albany Pass, with Somerset on the right and Albany Island on the left. The latter is interesting from its position as the site of an unpretentious

monument in the form of a wooden cross, to the ill-fated Explorer, Kennedy, who was speared by the blacks on the Escape River, while on the same side of the Island, facing the Pass, is the abandoned Station, formerly occupied by the late Mr. Savile Kent, when conducting his experiments in the artificial cultivation of pearls. At the Southern end of the Pass a projecting point of the mainland furnishes an excellent example of the mound building activities of the termite, and may be taken as typical of the white ant topography of North Queensland, to which I have already alluded. From here the coast line trends away Southerly in a succession of bays, points and headlands, being devoid of any remarkable topographical features, and with little to interest the eye, save long stretches of sand ridges that mark the shore line. On passing Cape Melville, my attention was called to a considerable area of rich sugar land along the Southern shores of Bathurst Bay, and I was assured by the Pilot, who knows the locality thoroughly, that this is supposed to be an excellent place for tropical agriculture. We reached the mouth of the Endeavour River, about 8 o'clock in the evening, and left on the following morning early, thus affording but little time to inspect the place, which I so greatly desired. However, the available couple of hours daylight from 5 o'clock till 7, before the "Warrego" cast off from the wharf, enabled me to expose a dozen kodak films, and to note the leading features of the town, so intimately associated with the name of that famous British circumnavigator, who discovered the Australian continent. Here, not more than a hundred yards from the foot of our gangway, he careened his tiny battered ship, the mutilated tree stem to which the vessel was moored being labelled by a plate inscribed: "This tree was used to moor the 'Endeavour' by Captain Cook, June 1770. Seagren, Mayor. Plate presented by Captain W. C. Thomson, F.R.A.S." A little way farther along, on the river side of the main street, stands the Captain Cook Monument, a gracefully sculptured column bearing the following inscription: "In Memoriam Captain Cook who landed here June 17th, 1770. Post cineres gloria venit." The top of this monument is in an unfinished state, the original intention evidently being to have the column surmounted by a bust or statue of the illustrious navigator. But whether this will ever be done or not, is of no great importance to anyone, the incomplete Monument as it stands, being doubtless preferable to the complete form with an indifferently executed statue. Anyway, the enterprising citizens of Cooktown cannot reasonably be accused of undue haste in the matter, and let us hope that rising generations of young Queenslanders will fully appreciate the good intentions of their forefathers in a

movement so closely associated with the early history of the State, and the discovery of the Continent. But they are a patriotic people with deep and practical sympathies, as evidenced by the public monuments that adorn the main thoroughfares of their picturesque town, the most interesting of which is perhaps the Memorial erected to Mrs. Watson, whose death under the most tragic and distressing circumstances occurred in 1881, on a lonely desert island North from Cooktown, and almost due West of Cook's passage, in the Great Barrier Reef, the incident being locally referred to as "one of the saddest of all the sad tales of the sea.*" The Eastern side of the Memorial has this inscription: "Memoriam. Mrs. Watson, the Heroine of Lizard Island, Cooktown, North Queensland, A.D. 1881. Edward D'Arcy, Mayor, 1885. Erected 1886." The inscription on the opposite side runs:

"Five fearful days, beneath the scorching glare,
Her babe she nursed.
God knows the pangs that woman had to bear,
Whose last sad entry showed a mother's care,
Then—'Nearly dead with thirst!'"
"John Davis, Mayor 1886."

Cooktown is the natural seaport of the Laura, the Coen, and the Palmer River Gold Fields, and other important mineral areas, including Maytown and the Collingwood Tin Mines. It is the outlet of an extensive coastal belt of rich, tropical, agricultural country, and supplies the Southern markets with large consignments of luscious fruits, of which the banana is not the least significant. The town is situated in a healthy position, with good natural drainage, and the main street is shaded by a beautiful avenue of trees. From the top of Grassy Hill, on the South side of the Harbour, a magnificent view may be obtained of the Great Barrier Reef on the one hand, and the

*Mrs. Watson was left on Lizard Island by her husband, a beche-de-mer trader, with a baby aud two Chinese servants. On the 27th September, the blacks came, and next day speared one Chinaman, and on the 30th speared the other in seven places, but the dauntless woman defended herself so resolutely with firearms as to drive them temporarily away. But to remain was certain death, and on the 3rd October she escaped in an iron tank, with her child, the wounded Chinaman, and a supply of provisions. They floated all night, and next day landed on a bare reef, where she remained till the 6th October. Water gave out, and the poor hunted woman pulled the tank and its contents over to No. 1 Island of the Howick Group. Search for water there was in vain, but natives were there, so she again started, and reached No. 5 Island, 40 miles away on the 8th. There, surrounded with water—but all salt—with plenty of provisions, which her parched and swollen throat could not swallow; with her child, only a few months old, dying before her eyes, while she herself suffered the tortures of Tantalus, she died of thirst.

NORMAN RIVER.

MOUTH OF THE NORMAN RIVER AT KARUMBA.

LAST OF THE KARUMBA TRIBE—MOUTH OF THE NORMAN RIVER.

BOOBY ISLAND, TORRES STRAIT.

GOODE ISLAND, TORRES STRAIT.

"QUETTA" MEMORIAL CHURCH, THURSDAY ISLAND.

ALBANY ISLAND, SHOWING ABANDONED ARTIFICIAL OYSTER CULTURE STATION, IN CENTRE.

SOMERSET, CAPE YORK.

SOUTHERN ENTRANCE TO ALBANY PASS, SHOWING TERMITE HILLS.

VIEW OF COOKTOWN (SHOWING CAPTAIN COOK'S MONUMENT), NORTH QUEENSLAND.

far away mountains on the other, with intervening hill and dale, island, palm and strand. The Botanical Gardens afford a convenient place for recreation, and within easy distance of the General Post Office are some places of interest to the appreciative and sympathetic observer, or those who wish to become familiar with the geographical conditions of the district.

The run to Brisbane, via Townsville and Mackay, was accomplished under similar ideal weather conditions to those experienced on the outward journey. And, now let me here remark, that in no other part of the world are these conditions more favourable than along the Queensland coast, especially during the winter months, steaming all the way in smooth water, under the protection of the Great Barrier Reef for over a thousand miles, the traveller may enjoy the pleasures of a glorious inland sea trip, free from the distressing symptoms of mal de mer right from Gladstone to Torres Strait, and even down the Carpentarian Gulf, for days or even weeks at a stretch. It is an ideal run, and in time is bound to become immensely popular for those seeking health and relaxation. Already, the citizens of Victoria and New South Wales are patronising this Northern winter tour, and are beginning to appreciate the advantages of a smooth sea and mild warm weather, at a time when the rigorous climatic conditions of the Southern States suggest something milder and less trying. A summer cruise in the Mediterranean lacks its advantages, and the much over-rated Inland Sea of Japan suffers badly by comparison. The great desideratum is to make this part of the Queensland coast more widely known, and to this end no pains should be spared, no expense should be considered too great, and no trouble too much, for in the long run it will yield a handsome return to the State.

In conclusion, it only remains for me to express my own personal obligations, and, with the concurrence of my fellow Councillors and Members, the cordial thanks of the Society to those who have helped forward the enterprise, of which the foregoing is merely the outcome. Although it is always difficult to differentiate in a matter of this kind, I may, perhaps, be permitted to allude to the helpful services rendered by the Hon. Digby Denham, Minister for Public Lands, whose material aid was greatly valued, the Hon. Sir Arthur Morgan, our distinguished President, Mr. George Phillips, our worthy Vice-President, who was really the originator of the movement, Mr. A. A. Spowers, Surveyor-General, whose sympathetic assistance was much appreciated, Messrs. Alexander Corrie, George Fox, E. C. Barton, James Stodart, and E. E. Edwards, who contributed to the expenses of the expedition, to Mr. and Mrs. Thomas Graham,

and Mr. Whittaker, of Magoura Station, Normanton, for valuable services rendered, and to Mr. C. V. Allom, also of Normanton, whose attention to the interests of the Expedition contributed much to the success achieved; and finally, the best thanks of the Society are due to Mr. Scriven, the courteous Under Secretary for Agriculture, to whose kindness we are indebted for having the lantern slides prepared; to the Chief Secretary for assistance rendered in the preparation of the accompanying illustrations, and to Mr. T. C. Troedson, Director of the Intelligence and Tourist Bureau, for helpful attention.

NOTE BY MR. GEORGE PHILLIPS, VICE-PRESIDENT.

The finding by Mr. Thomas Graham, of Magoura Station, near Normanton, of the trees marked by Burke and Wills, at their most Northern Camp, No. 119, together with the complete and unquestionable verification of the trees and camp by Dr. J. P. Thomson, the Hon. Secretary of the Royal Geographical Society of Australasia, Queensland, finally sets at rest all doubts as to the exact spot where the ill-fated Victorian explorers reached tidal waters on the Gulf of Carpentaria.

The locality of Camp No. 119, is now marked on the official maps of the State, and is a record of the Surveyor-General's office.

Application has been made to the Government to have the site of the camp permanently reserved, in order that at some future time a suitable memorial may be raised to the memory of the men who first crossed the Australian Continent from sea to sea.

Previous to Mr. Graham's discovery and Dr. Thomson's verification, there was not a living person who could have indicated the exact locality of the camp, and I may add that the universal impression of old hands in the Burke district, during the last forty years, was that Burke and Wills reached tidal water on the Albert River, at or near the site of Burketown.

SOME PROBLEMS OF QUEENSLAND HYDROGRAPHY.*

By Dr. J. V. DANES, Asst. Professor of Geography, Bohemian University, Prague.

For several reasons, I feel obliged to apologise, that I, as a stranger only after a few months' rambles in this state of enormous area, take the liberty to address you upon some questions, some problems, whose final and satisfactory solution cannot be expected in a very short time nor by a single individual either. I ask also your indulgence for my foreign accent, and mispronunciation of your language, and beg you to consider my further explanations mostly as suggestions, resulting more from studies of works of your scientists and surveyors, from personal information gathered from your men of science, in the first place from gentlemen of the State Geological Bureau, rather than from my own observations. The final proofs of the following statements and theories cannot be expected in a very near future, but I am persuaded that problems of this kind are important and clear enough to be considered as one of the most interesting features of the last periods of the geological and geographical development of this part of the Australian continent.

Before I proceed with the explanation of the special subjects of my lecture, I take the liberty to ask your attention for some considerations concerning the development of the rivers, as revealed by the most prominent geologists and geographers of the last three or four decenniums. The water falling upon the surface of the earth from the atmosphere naturally follows the shortest way, the steepest gradient from the mountains to the sea or any other low-lying basin. The slope of its course is generally very high near the heads of the rivers, and gradually diminishes in the middle and lower part of their channels. It would be always so, if the surface features of the continents would not be so complicated, and if the structure of the rocks forming the surface

* Read before the Royal Geographical Society of Australasia, Queensland, July 21st, 1910.

would be homogeneous. But the variety in the hardness, permeability and tectonical structure of the country rocks, and the trend of the mountains rising often opposite to the natural shortest flow of the creeks or rivers, they are bound to many deviations for to reach their final goal, the sea or some inland basin in low position. The final result of the destructive forces, mainly of the flowing water, upon the surface of the continents and islands, would be levelling them to an almost level plain, rising only imperceptibly over the sea. The work ot those degrading agencies would have been several times accomplished as provided by the geological history of the earth, if the inner forces of the earth would not produce new mountains and new depths, new variation of the earth crust's relief.

The internal forces of the earth are in perpetual activity. The earthquakes and volcanic eruptions are the violent expression of those processes which work without interruption upon the transformation of the earth's surface. Certainly, no part of the earth's surface is completely rigid and exempted from the irregularities caused by those forces, but there are certain belts of great disturbances, where the activity seems to be eminently concentrated. There are two of those belts which are the most important throughout the earth's history, one is the so-called Mediterranean, which comprises the Antillean region in America, and the high mountain ranges of Central and Southern Europe, Northern Africa, and Western and Central Asia ; the other follows the margins of the Pacific Ocean, and the mountains along the Eastern Australian coast are one part of that Pacific belt of mountain systems.

Bending, faulting and folding of the surface rocks produce new irregularities, and put new obstacles into the way of the rivers. Those are bound to cut through new rising mountains or elevations, or give way and beat a new course, where the obstacles are not so unsurmountable. The change in the slope gives advantage to some stronger stream, to cut back its valley and capture other streams, whose progress and erosive activity have been hampered by some obstacle. Rivers with greater quantity of water, and with greater slope, extend their basin to the disadvantage of others not so vigorous in their activity. In thousands of single cases such capture or piracy has been proved, and it shows, that the divides between different river basins are not stable at all, and that they are indeed one of the most changeable of the physiogeographical features upon the earth's surface. The captures go on, not only in little streams, but are very common with some of the greatest streams of the world, whose evolution is often astonishingly complicated. Violent and permanent bends in river courses, sudden changes of the direction, especially in mountainous

uneven countries, waterfalls, gorges and rapids in the middle and lower course, are the most eminent proofs of some violent change of the river-course, and a closer study of the surrounding country reveals that such river is a compound of several formerly independent courses. Look upon the map of Queensland, and you can easily observe that most of the principal rivers draining to the eastern coast have a most curious course. Take for example the Fitzroy and Burdekin as the most striking illustrations. The head rivers of the Fitzroy, the Nogoa and Comet flow to the North, then form the Mackenzie flowing to North of East, and suddenly where the Isaac River joins, bend to the south-south-east, meet the Dawson flowing exactly from south to the north, break in a narrow gap through a mountain range, follow a sharp knee to the north, and end finally with a south-south-east course into Keppel Bay. A better example of a compound river can hardly be given ; not many rivers in the world contain so many puzzles for a physiographer as that river. And something similar about the Burdekin, first flowing to the south-west, then almost east, after juncture with the Clarke following its course, then flowing continuously to south and south-east until below the junction of the Suttor, it bends suddenly to the north, and in a narrow gorge with waterfalls and rapids, breaks through the Leichhardt Range, and builds its famous delta far into the sea.

Many deviations in the river-courses, especially in Southern Queensland, and also north from 21° of latitude, have been caused by violent volcanic eruptions, and lava flows changed in places completely the former landscape, covering it with some hundred feet of volcanic material, but it is clear that the volcanic eruptions had comparatively little to do with those striking irregularities in the river-courses. The Burdekin, for example, was met in the middle course by the end of the great basaltic outflows, which formed the famous great wall, but that circumstance caused only a slight, although very interesting change in his course.

One of the most interesting, although comparatively insignificant in its size is the Barron River. The Barron rises on the ranges encircling on the southern side the Atherton Plateau, flows quietly to the north, through the plain of Mareeba, as if it would continue through the low and broad gaps to the north into the basin of the Mitchell River, but bends suddenly to the east, and then to the south east, and forms the famous falls, and the not less wonderful gorge. Its principal affluents, as for example the Clohesy, meet its course under right angles, a circumstance also very remarkable for the comparative youth of its course to the east. Not only the Barron, but many other rivers draining to the east, experience sudden bends

in their course, and form astonishingly high waterfalls and deep, narrow gorges far from their heads, in the middle or lower courses. A phenomenon so uncommon in the ordinary evolution of rivers, must have an important cause, which affected the whole of the north-eastern coast. The explanation would be as follows. The visitors to Cairns can observe especially north from Townsville, that the steep coastal range forms a wall of uniform elevation for a considerable distance. The same phenomenon you can observe climbing upon the Walsh Pyramid south from Cairns, about the range limiting to the west the basin of the Mulgrave River, and probably, most distinctly following the coast between Cairns and Port Douglas. It seems as if a level plateau has been sharply cut through, and one half of it submerged under the sea, the other facing with the sharp, steep side the shore. Also, the steepness of the other coast ranges, where they are not part of the hinterland plateau is astonishing and uncommon. In the rainy season, numerous perpendicular waterfalls can be observed falling from the steep mountain slopes directly to the low, narrow, coastal plain, and frequent exposure of bare rocks and immense boulders scattered below the foot are witnesses of frequent and violent avalanches.

It is very well known and proved by investigation in several branches of science that the Australian continent extended in a not far remote geological period beyond the Barrier Reef, probably far into the Coral Sea. Violent bending and faulting of the earth's crust submerged that part of the continent, and the chief break occurred along the steep escarpment facing the coast. The outer range with deep submerged base forms the Great Barrier Reef, and another steep escarpment follows on its eastern side, into the depth of the Coral Sea. That event is the most important in the post cretaceous evolution of the eastern part of the continent, and affected in different degree, not only the Queensland coast, but is known also and far better investigated along the coast of New South Wales and Victoria. If the mountain ranges on the continental side remained in their former position, or have been elevated, it is not yet possible to state in general. That the elevation occurred in some parts is evident. Mr. Ball found many proofs of an elevation in the Cooktown district, and the highest mountain ranges of Queensland, the Bellenden Ker and Bartle Frere, suggest by their forms also a considerable elevation in not very remote past.

It is not yet possible to give to that great tectonical process its exact position as to the geological age, but the freshness of the bold forms, the height and uniformity of the waterfalls prove that it finished in the not very remote past, probably in the late tertiary period.

I guess that it would be possible to undertake an approximate measurement of the time elapsed since that great event, by careful registration of the recession of the Barron Falls, and possibly also others. The exact measuring of the recession of the Niagara Falls has been very important for approximate estimation of the period elapsed since the last great glaciation in Northern America, and I don't see why it would be impossible on your splendid waterfalls in the North to try the same. It is an open question, if the recession of the Barron Falls is great enough to be measured, to be perceived in a short space of time, say in every three or five years ? No doubt the hard schists in the Barron Gorge are much more resistent, than the soft shales, capped by limestone in the Niagara Gorge ; but it is necessary also, to consider the immense quantity of sand, and gravel, and boulders carried by the Barron in flood time, and on the opposite the complete clearness of Niagara water, which carries hardly any material stimulating the erosive action. I should be glad if the Council of this Society would be disposed to take into consideration my direct proposal, to establish a regular measurement of the recession of the Falls in certain periods. The expense would not be very high, and the results would be certainly very important for the science in general.

The general result of that great tectonial event was that the coast-line, the level of the sea, has been put a considerable distance nearer to the present divide ; the steep lofty ranges brought most of the atmospheric moisture to precipitation in a short distance from the shore; creeks of short course, but with terrible force, cut back into the rim of the now coastal range, and succeeded quickly to divert into their direction many of the older rivers, whose old course has been mostly conformable with the general strike of the mountain ranges. Although the capture was most astonishing on the eastern side, also some rivers flowing to the west, and especially to the Gulf of Carpentaria benefited by it. The features on the map show us the upper courses of the Gilbert River, Einasleigh, Lynd, Walsh and Mitchell, flowing originally to the north, but deviated further suddenly to the west or north of west. That circumstance seems to suggest the general elevation of the ranges, although probably the high capping of the ranges by basaltic plateaux, probably contemporaneous with the great tectonial process, was alone responsible for the invigoration of the erosive activity of the rivers. It seems now that the process of sinking is played out on the eastern coast, and on the contrary a slight elevation has been experienced in recent times as some uplifted coral reefs and alluvial terraces near the sea-shore prove distinctly. I can, from my own observation, corroborate the known facts by raised sand beaches and small deltas along the coastal range

near Cairns, and elevated terraces of gravel on the lower course of the Mulgrave River.

The Trinity Bay, on whose shore Cairns is situated, reveals a very interesting feature. The Trinity Inlet continues in several deep arms, some miles to the south, and has an appearance of a delta, but the big river, which created the delta is conspicuous by its absence and only some insignificant streams flow in from the near ranges. It is believed generally that the Mulgrave River now joining the Russell did flow formerly to the Trinity Inlet. I was not able to find any direct proof to that theory, but there is an obstacle whose origin and action could easily be held responsible for such a fact. A little volcanic hill, known as Green Hill, stands out half-way between the knee of Mulgrave and Trinity Inlet. Its origin is certainly very recent, and its lava and tufa deposition, although by no means very extensive, would be sudden and high enough to divert the stream into the other direction, where no such obstacle existed.

The expression, " the Dividing Range," so commonly used and believed as important by the general public in Australia, would be no where more out of place than here. It is no good to impress upon the public the importance of something which is in reality very volatile and sometimes does not exist at all. The people speak and believe about the Dividing Range, although it would be necessary to take refuge in the spirit level for observation of some rise in the level of the country. Such is in fact, the Dividing Range from Torrens Creek to Kynoona, and once more on the Barkly Tableland, and in some places further on into the Northern Territory. Every slight change in the stability of the continent, a small sinking or rising of the coast must affect such ill-defined divide in great measure. Indeed, it seems to be proved that the basin of the Gulf gained much on drainage in recent times by capturing the heads of some rivers flowing formerly to the south-west into the interior basin of Australia. I found evidence of such piracy in the case of the Upper Flinders River, which formerly undoubtedly joined the Thomson River, and later has been diverted into the present direction. The falls and rapids on the lower course of the Leichhardt and Flinders Rivers are unmistakeable proofs of a recession of the sea, respective elevation of the surrounding country.

We see the present drainage of Queensland developing after rigorous changes in the elevation of the country. But what was the state before that change ? The sea on the eastern side of the continent was much further away, and the slope of the country much less than now. The old river courses follow mostly the great tectonical valleys in the north-southerly direction, and there are many reasons to believe that they never crossed the ranges dividing them from the sea. Those

basins were without outlet, each independent from the other. Some of those basins have been covered by lakes or swamps, whose deposits are pretty extensive, but have been little studied as yet. Some of those deposits preserved the bones of the big prehistorical marsupials. The Leichhardt and Gregory presume the existence of such basins without outlet for the Darling Downs country, and I am inclined to believe that most of the inland basins within the eastern mountainous parts of the State have been without outlet too. The tectonical disturbances gave to the rivers greater slope, and they cut back and captured those inland basins one after the other. The greatest prey had the rivers flowing to the eastern coast, their slope and force being the highest.

Of the formerly certainly numerous small inland basins without outlet only two remain until the present. They are within the Main Dividing Range, or better Dividing Plateau, between the Central and Northern railway line. The southern comprises the area drained into the Lake Galilee; the northern the area drained into the Lake Buchanan. Both lakes are very shallow, and the relief of both basins is very flat, the divide is generally crossed without taking notice of it. Lake Buchanan is very salty, Lake Galilee much less, but the salinity is not only work of evaporation, the rocks, soft mudstones, in the vicinity being salty.

REPORT ON A TOUR ALONG THE DIVIDING RANGE (BETTER PLATEAU) FROM ARAMAC TO PENTLAND.

By Dr. J. V. DANES, Asst. Professor of Geography, Bohemian University, Prague.

(WITH 2 PLATES.)

PREFACE.

The so-called Dividing Range, or better Dividing Plateau, between the Central and Northern Railway line, being one of the least known parts of Queensland, and promising to contain many interesting objects for geographical investigation, especially some lakes about whose existence very little was known, except that their shape has been comparatively well outlined on the State official maps, I resolved to visit that country and gather as much information as possible about its nature.

The following report is the result of a 3 weeks' journey covering about 400 miles, 340 on horseback and 60 in vehicles.

My results would not be so satisfactory without the kind support of the residents of that sparsely populated country, who by kind and true Australian hospitality, by information and active help, brought much to the comfort and success of my undertaking. Not less, I owe my sincerest thanks to the Government of the State, who by granting a free pass on the State Railway Lines, and an open letter of introduction to the residents of the State gave me very valuable support.

Most hearty thanks are due, also, to Dr. J. P. Thomson, the Honorary Secretary of the R.G.S.A., Queensland, for corrections to my imperfect English and the care he voluntarily gave to this paper.

On the 22nd April, I started from Aramac on horseback, with one pack-horse, in a Northerly direction. The plain, now dry and covered with splendid Mitchell grass, rises almost imperceptibly. The drainage is directed to the South, the Aramac Creek being the

receptacle of waters from a vast area of rolling downs country, although the inclination of the surface towards it is very slight. In places angular boulders of brownish, soft sandstone are scattered over the surface, without doubt remains of a once continuous complex of strata. The desert sandstone plateau is visible in the east and north-east direction sloping abruptly to the 2 to 300 feet lower plain. The elevation at Aramac is 850 feet, little less than Barcaldine, the watershed being very much nearer to the latter place. Mr. McAuliffe's place, Stagmount, lies about 920 feet, and has a magnificent artesian bore, with a daily flow of 664,000 gallons of water, 89° F., slightly mineralised and with sulphurous smell. The bore is 1,000 feet deep. Another bore on the same selection lies about 5 miles further to the north, 990 feet high, but so far without flowing water. A sub-artesian flow was struck at a depth of 730 feet in a sand-drift; the artesian flow lies probably very deep, the present depth of the bore is 1,400 feet; the last 200 feet in soft clayey blue shale. From that bore I proceeded in an easterly direction. A detached part of the desert sandstone plateau starts within a distance of 4 miles east of the bore, and proceeds about 8 miles in a N.W. direction. The easternmost top called "Pinnacle" is about 1,100 feet high, and rises a little more than 100 feet over the neighbouring plain in a southerly direction. The foot region and slopes are covered with angular pebbles of ironstone, jasper, and quartz; the surface of the hill being highly weathered, it is impossible to determine exactly the position of the strata. Soft, marly sandstones, containing some lime are interbedded, and overlaid by hard beds of dark brown ironstone, and white silicified conglomerate. Open forest, consisting mostly of so-called black brigalow (black gidya) covers the hill, and extends far in a southerly direction. To the east the open plains prevail, with groups of trees scattered near the forest; further to the east, only along the watercourses and around the waterholes trees grow. Vast barren claypans prevail on the western and north-western side of the lake separated from the watershed by sandhills fastened by dense growth of spinifex. The surface of the claypans cracks in the sun glare, the particles of soil are loosened by stamping of thousands of sheep running to and from the waterholes, and the wind sweeps the dust away to the north-west. In hot sunny days the whirlwind plays over the claypans carrying dust high into the air. Lake Mueller consists of two sheets of water, which only after heavy rains are connected by some hundred yards of broad, shallow swamp. In long, continuous drought the lake dries completely; the Southern part first, the Northern a little later. At the time of my visit, the Southern lake covered an area of about 1½ square miles, and the

depth did not exceed 4 feet in the deepest parts; the watermarks on the beach and spinifex covered dunes indicating the highest water stand about 3 feet 6 inches higher. The lake was without outlet; but when higher it covers two claypans in the south and southeast-continuations of the lake and overflows to the South, forming the so-called Pelican Creek. The greater part of the water which the Mud Creek brings from the western direction, does not reach the lake in the flood time, but continues directly through the claypans into the bed of Pelican Creek, communicating only through narrow channels in the sand dunes belt with the lake. From the N.W., another watercourse, the Sisters Creek, issuing from two elliptical promontories of the plateau called the Sisters drains to the lake, and some other smaller watercourses on the north and east side run down from the plateau after rains. A great number of permanent springs issue from the ground in the lakes, around them, and especially under the foot of the range. Dense growth of bulrushes covers the circular or elliptical holes filled with more or less muddy, bluish tinged, slightly brackish, warm water 80° to 82° F. The biggest of the springs, so-called Mud Spring, is close to the foot hills about $1\frac{1}{4}$ miles north from the north border of the lake. It is enclosed by barbed wire fence, as it is dangerous for heavy stock. The water has been extensively used in former times by the carriers coming from the Plateau to Aramac. The springs, although they never get dry, are not able to maintain the water in the northern part of the lake permanently; the water flowing out of them evaporates soon after leaving the shade of bulrushes and trees. The northern part of the lake covers about $2\frac{1}{2}$ miles, and is a little deeper than the southern one. Plenty waterfowl live around the water sheets, but only one kind of fish, the Perch, seems to live in the water. Skeletons of small crabs and lobsters are found profusely on the shores. The water in both is of greenish brown tinge and muddy taste. In the claypans in places a tiny sheet of salt remains, very thin and of bitter salty taste. The water level in the lake is at an elevation of about 910 feet; the sandhills in the spinifex belt rise to 30 feet above the water level. The place occupied by Mr. White, Edgbaston, is on the edge of the claypans about $\frac{1}{2}$ mile N.W. from the northern lake, 930 feet elevation. The permanent supply of water by the springs is a good guarantee for the prosperity of the place, invaluable in a long drought time. The spring water by its quality and temperature, also the position—300 to 350 feet—under the top part of the plateau seems to be of the same origin as the so-called sub-artesian flow, which is tapped in some places by the bores on the plateau itself.

On the north-western side of the lake, the plain rises very slowly

to the "Sisters," and is covered densely by angular pebbles of ironstone and jasper, some of them showing distinctly the polishing action of the wind-driven sand and dust. On the northern and north-eastern side of the lake the foot of the plateau is fringed by a terrace rising sharply to 40 feet from the low plain in the spring belt. The soft ground along the springs does not permit the natural slow slope of the foot region Deep ravines divide and cut the terraces converging into the plain. The lower parts of the terraces, so far as I have seen, are built up of pebbles and rock debris, higher up the hard ironstone and silicified layers outcrop in places. The surface being covered by debris and vegetation, it is not possible to determine exactly the nature and thickness of the different strata along the slopes of the range, the soft, marly sandstone varies with hard quartzitic sandstone and ironstone, and the hard rock is especially thick in the highest part. The slope, especially on the north-eastern side of the lake is in places a very steep scarp, on the northern side the incline varies between 10° and 20°. The ravines indent the rim of the plateau not very deeply, they begin almost without any transition by deep, narrow incisions. Along the rim 300-500 yards away the plateau is covered by dense broombush, further inside by open forest. The rock is mostly covered by half to one foot thick of sandy soil, reddish yellow to dull brown in places; only the more barren places indicate the outcrop of ironstone and silicified strata, that occur mostly in the highest parts of the plateau. The strata seems to dip gently towards N.N.E. and N.E. An accurate measure is impossible, owing to the disintegration of the surface rocks.

The elevation of the southern part of the plateau from the northern end of Lake Mueller to the old Barcoorah Station is about 1,150 feet. The environs of the old Barcoorah Station belong just to the western drainage into the Corinda Creek. There is a permanent spring at the station, issuing from a soft sandstone underlaid by the hard ironstone. The temperature of the water is 72° C. It shows the same blue tinge and muddy taste. In the bed of the creek to the S.S.W. of the Station is another spring of the same temperature, and further to the west below the slope of the range a number of springs occur, issuing mostly from the rock fissures. They are probably of the same nature as the mud springs in the Lake Mueller basin. The subartesian bore at the old station is over 300 feet deep; the water is pumped out by a windmill, which was out of action during my stay. The water develops the same sulphurous smell as the waters in the Lake Mueller basin. Following the road to the new Barcoorah Station, I crossed the most imperceptible watershed in the forest country. Rock outcrops are rare, the angular,

hard jasper and ironstone pebbles are very numerous near the shallow creek bed. The elevation of the Barcoorah Station is about 1,120 feet, the depth of a subartesian bore about 300 feet, the temperature of the water 80° F. The Lake Barcoorah covers a shallow basin of about 2 square miles, but at present the border of the lake lies between 3-500 yards beyond the limit of the Tea-tree forest, joining a vast area of submerged forest country to the lake basin. To the S.W. the lake extends into a long inlet, into which its chief tributary, the Sache Creek, drains. This was about 4 feet deep where we crossed. (Mr. Jones, the Manager of Barcoorah Station, accompanied me to the lake). The highest watermark was about 3½ feet above the actual level. The watershed on the western and northern side is very low, rising not higher than about 40 feet above the present level. The lake was actually without outlet, and has the same character during the dry seasons, getting completely dry in a long continuous drought In heavy floods there is an outlet from the south-western inlet, the water overflowing to the Stainburn Creek. One arm of the Sache Creek drains into the lake, the other runs directly to the west. At present the creek was not flowing, but its bed contained some deep waterholes. The level of the lake is about 1,060 feet above the sea level. The water of the lake is grey blue and slightly muddy, the greatest depth at the present level 6 to 7 feet, the temperature 1½ feet below the water-level 74° C. ; in a neighbouring well in deep shade (fed by soakage) only 71.5° C. About 2½ miles north from the Barcoorah Lake are two subartesian bores only 72 feet deep ; further on about 3 miles to the north on the Reedy Creek Station, is an artesian bore 250 feet deep, with an outflow of 110,000 gallons in 24 hours.

Starting from the new Barcoorah Station towards Lake Dunn, I traversed a broad belt of watershed country, above 1,200 feet in elevation, covered by good open forest on the western side, by stunted vegetation further to the east, where the hard ironstone and silicified beds outcrop, and are covered only by reddish and deep brown sand and gravel. Spinifex develops where the wind-driven sand accumulates into low dunes. The eastern and northern part of that watershed drains to the Reedy Creek, which forms the outlet of the Lake Dunn, and reaches with its upper tributaries far to the east, further than any other western watercourse in the central part of the Continental Divide. The first tributary is crossed by the road about 13 miles west from Lake Dunn Station, and further to the east the road continues very near the southern bank of the main creek. Reedy Creek was running in a rocky bed, the stream varying in breadth between 5 to 10 yards. The banks of the low water bed lie

about 50 feet deep in the surrounding country, the highest watermarks being in places more than 25 feet above the banks. Alongside the river very deep sand covers the soil and the road, making the passage very slow ; the wind-driven sand accumulates on the northern right bank in dunes, the nearest to the creek being usually barren, the further covered more or less by spinifex. The bed of the Reedy Creek about 10 miles from Lake Dunn, lies about 1,080 feet, and has usually quickly flowing current. It cuts, as told me, in a comparatively narrow gorge, through the high part of the plateau in a north-westerly course about 12 miles east from Barcoorah. The Reedy Creek leaves Lake Dunn at its south-western end, and will be artificially cut off after the floods to keep the water in the lake before complete dessication.

The basin of Lake Dunn is $1\frac{1}{4}$ miles broad from north to south, and 2 miles long from E.N.E. to W.S.W., with an area of about 2 square miles. A broad belt of swamp extends to the N.E. of the open water sheet. Mr. Tamland, who has resided at the lake about 28 years, and is the oldest resident in the surrounding country, was able to furnish me with the following data. At the actual level, the greatest depth of the lake is about 8 feet, it dried completely out in the years 1884, 1886, 1898, and all through 1900 to 1901 ; very big floods occurred in March, 1890, the water reaching about 5 feet above the present level, 1906 about 4 feet, and in March present about 10 feet above the level, reaching 5 feet high in the rooms of the Station House. The ground of the lake is solid, sandy clay. When Mr. Tamland came to that place, the present bed of the lake was covered by a forest of willows, growing in an extended swamp. After the trees had been cut and burnt up, the true lake developed. It seems that it slightly deepened, the particles of soil being carried away by the creek, and by the wind in the drought time. The level of the lake is in an elevation of about 1,100 feet above sea level, the water is clear and drinkable, of green bluish colour, 73° F. 1 foot below the surface. Around the southern border of the lake at a distance of some hundred feet of the water sheet, permanent springs issue beneath a bed of soft permeable sandstone. The water is a little muddy, of bluish tinge, the temperature of one spring being 73.5°, of another 71° F. On the selection of Mr. MacAuliffe to the S.E. from the lake, the water has been struck only in a corresponding level in sandstone by sinking a well.

In the N. and N.W. direction from Lake Dunn to the Black Swamp, which lies on the supposed to be outlet of the Lake Galilee, the plateau with outcropping rocks is crossed (ironstone and silicified hard sandstone). On the northern verge of the plateau, the Yellow

Waterhole Creek issues from a group of springs, which gather from a stratum of soft whitish sandstone 3 feet deep, overlaid and underlied by the hard ironstone and silicified beds. The water is of blue tinge in a natural state, but in some of the springs has a yellow reddish colour, caused by solution of the superficial soil. The springs are permanent, so is another group further to the S.E., and another at the Black Swamp Camp. The Yellow Waterhole Springs are in an elevation of over 1,160 feet, the Black Swamp Group about 30 feet lower. The character and the temperature (71-73° F.) of the springs are about the same. From the springs near the Camp, a now dry watercourse drains to the west, to Reedy Creek, and is joined by another sandy bed, which comes from the Black Swamp. Mr. Briggs, who for several years has resided near the place, assures me that he never saw the swamp overflowing really, although in a very high water storm it seems to drain for a very limited time to the west. Mr. Briggs and Mr. Tamland assured me that they never saw the Lake Galilee overflow in the presumed direction, and that they are inclined to see a mistake in the indication on the map (1 inch—4 miles map). With Mr. Briggs as guide, I had the occasion to examine the supposed to be outflow, and was able to collect the following facts :—Between 3 to 4 miles north from the south-western edge of the lake, three broad, shallow channels are distinctly seen in the forest country, their margin covered with black tea-trees, and the bottom by salt bushes and grass, the soil being bluish clay, with here and there sandy heaps overgrown with spinifex. The channels continue 1 or 1½ miles to the south of west near to the Black Swamp ; in the opposite direction to the lake they lose in distinction and rather irregular low relief of rounded elevations and small claypans prevail. The clay is in places covered by a thin sheet of salt from the evaporated water, and itself has a strong salty taste. A well has been sunk in the bottom of one of the mentioned channels, but only very brackish water was struck. Not far from here to the north on the Fleetwood grounds, a bore got only salt water from a depth of 700 feet.

The level of the channels about a mile from the lake is about 80 feet above the level of the water in the lake, and the Black Swamp with its surroundings being certainly 100 feet above the same level, it is quite impossible that in any historical time the lake did overflow.

In the present year's flood, the highest known as long as history runs, the water in the lake was only 2½ to 3 feet higher than the present level. The old channels seem, on the contrary, to be obliterated remnants of former longer watercourses, which brought to the lake the water from the west and south-west before Reedy Creek cut them

off by its more vigorous erosive power. The valley of Reedy Creek to the east from Barcoorah is certainly comparatively very young, and it is very probable that the area of the big lake without outlet extended formerly much further in that direction.

Lake Galilee is, in reality, a lake without outlet, filling up the lowest parts of a shallow basin enclosed on all sides by slightly higher parts of the Dividing Plateau. Its level is on the map correctly about 1,025 feet, the divide only in the north-west attains more than 1,300 feet elevation. Broad Islands divide the south-western part of the lake almost entirely from the main body, and the north-eastern part being only a broad shallow inlet, only the south--eastern part, the so-called "Big Arm," represents a permanent lake of comparatively considerable depth, at the present level in places to 15 feet. The connection of the south-western arm, the so-called "Salt Lake," with the main body soon ceases, and the water becomes intensely salty, evaporating completely in heavy droughts. In 1900-1 the whole lake was dry, except the deepest parts of the Big Arm. On the western shore of the Salt Lake a broad belt of country is devoid of forest, and covered with salt bushes and other halophylous plants. On the southern shore open forest grows on low ironstone ridges, protruding deep into the lake, and forming also the bulk of the islands. Broad shallow inlets of water extend into the valleys between the elevations. Those valleys continue far to the S.S.E. and south, and are covered with grass, fringed by black tea-trees, and holding in places numerous waterholes or small marshes. The bottom of the lake, and also of those valleys is a very hard impervious bluish clay, which is in many places salty. First, I was inclined to see in the "Salt Lake" a miniature of karabogaz, it being without direct inflow of a larger body of stream water, getting wind-driven water from the deeper part of the lake and evaporating more quickly; but after having investigated the other part of the plateau, I think that the salt is more due to the solution from the salty clays and mudstones than produce of the intensified evaporation only. At the present, the depth of the Salt Lake was not above 5 feet, where I crossed only about 4 feet. The water was only slightly brackish, and the horses drank it with delight. Its colour is a dirty white, milky, and tastes very muddy, except brackish. At the lake an immense number of diverse water birds live, pelicans, ibis, black swans, spoonbills, ducks, etc.

The islands and a broad belt of shallow water divide the Salt Lake from the Big Arm, whose deepest places lay at the mouth of the broad, deep inlet to the S.E., into which Dandy Creek drains. Searching with a party from the Eastmere Station for black swan

eggs, very numerous on the islands and shrub and grass-covered shallow parts of the lake, I waded in an extensive area on the western side off the deeper parts of the Big Arm, and found there the bottom only 1 to 2½ feet deep, water of milky colour generally, but brownish green in places, the taste being exceedingly muddy. The temperature was 1 foot below the surface, 78° about noon, but in a place exposed the whole day to the piercing sun rays. On the eastern side a considerable area of country drains into the lake, Duck Creek and Dandy Creek flowing until now in lower course, and holding plenty of deep waterholes long into the dry season. The waterholes at Eastmere Station (on the Dandy Creek) lay in a porous sandstone of the same appearance as at the natural springs described previously, the same water-bearing horizon extending far to the S.E. along the Creek, as Mr. Anderson, the Manager of the Station, informed me. But the sinking results in the neighbourhood have been unsatisfactory, in two bores to 400 feet deep, only very brackish water being struck. The east shore of the lake is indented, the ironstone ridges forming peninsulas between broad, shallow inlets, and the N.E. part of the lake is nothing more than a very broad shallow basin which often is completely dry. I crossed it on the road to Fleetwood, the water sheet being more than 3 miles broad in that place, but only to 3 feet deep. On the north-western and also the north-eastern side the open forest reaches near to the shore, willows growing profusely in shallow depths, except low shrubs and diverse grasses. The north-western part of the drainiage area is very flat, and no important watercourses drain to the lake, the water on Fleetwood Station being taken from artificial dams. I proceeded from Fleetwood in the N.N.W. direction to open forest country with mostly sandy soil, ironstone outcropping only near the divide, where a shallow creek bed reaches into the rock below the weathered soil. The lower course of the creek is very indistinct, only some shallow waterhole s far apart one from the other marking the probable direction of the drainage The Divide between the outletless basin and the Belyando respectively, the Carmichael Creek and Dyllingo Creek, is only 1,250-1,300 feet high along the road, and rises slightly to where the range is only about 1,400 feet high. The upper basin of the Dyllingo Creek is a very well watered country. The creek beds cut into the underlying silicified sandstone and ironstone beds, and contain many deep waterholes, some springs being permanent. Low, oblong ridges cross the country in the north, south and N.N.W. to S.S.E. direction, built up from very hard silicified sandstone; small swamps occur, generally on their western side. I did not follow the Dyllingo Creek further down to the east, but I got reliable information from the

the residents in the country that several water horizons are crossed by the creek, the biggest springs being near Doongmabulla about 3 miles east from the junction of Dyllingo and Carmichael Creek They issue a permanent stream of water, whose capacity is estimated at least to 1,000,000 gallons daily flow. I crossed the Dyllingo Creek in an elevation less than 1,100 feet, Annievale being about 1,500 feet, Doongmabulla is probably situated in an elevation of about 900 feet above the sea-level. The water at the springs is cold, and very good for drinking purposes.

From Annievale I crossed two creeks with rocky beds in ironstone, and proceeded over a very indistinct watershed to Bowie. The country is covered by open forest generally, only where the rock is covered only by a very thin sheet of soil the wattle and other low shrub formations prevail. The watershed is only about 1,250 feet, Bowie about 1,150 feet. Bowie Creek had abundant big waterholes near the station, and was accompanied by claypans in places. The Bowie Creek drains into a long, narrow arm of Lake Buchanan, about 6 miles north from the station. Extensive claypans occur along the south end of the lake. I proceeded along the mailman's track on the eastern shore of the lake; open forest gives place to grassy plains on the low elevations; the depressions are covered with water and form claypans. The general trend of those depressions is N.N.W. to S.S.E., and they are connected with the lake by narrow openings between the 6-10 feet higher elevations, consisting of white or bluish marls and mudstones. Long, low clay and sand banks follow the openings and leave generally only a narrow deep (4-5 feet) channel for communication of the waters. The whole eastern shore of the lake is of the same character, the wind-driven water accumulating sand and silt in the north-westerly direction, and forming beautiful miniature examples of diversified shore formations. The accumulation of the sediment forms narrow, sharply to N.W or N.N.W. protruding, low peninsulas, with lagoons behind, only occasionally by means of narrow, deep channels connected with the main body of the lake. The highest watermarks indicating the waterstand during the unusually high flood in March this year are not higher than 1 foot 4 inches above the present water level. That fact is surprising in the first moment, confronted with the much higher contemporaneous watermark on Lake Galilee, but the explanation is as follows:—The rising of the water only some inches above the present level, extends the water over very extensive dry pan flats, and so adds a very considerable area to the lake, which increases with every additional small rise very much. Lake Galilee has not nearly so much space for expansion, the shores rising very near the water level comparatively,

and only in some inlets the area gains, but in no proportion in comparison with Lake Buchanan. The longest tongue-shaped peninsula protrudes far into the lake south from the mouth of Stockyard Creek, probably the greatest tributary on the eastern shore. I did not see the south-western shore of the lake, but from a description I got, mostly from Mr. Craig, the Manager of the Yarrowmere Station, its character would be about the same as of the eastern shore. No doubt, there are extensive claypans, then the whirlwind finds there material for very high and long lasting thick columns of dust. The north-western shore is accompanied also by many low-lying swamps and lagoons, which are flooded by the lake in a very high waterstand, but the shore is uniform, not indentated, the wind driving the water and suspended material almost perpendicularly against the shore, and not diagonally or parallel as on the eastern, and probably also the south-western shore. To the north a long arm of the lake fills the mouth of the Magga Creek, without doubt the most important of all the tributaries of the lake. That creek brings water not only from an extensive area on the north and N.N.W. side of the lake, but also receives the creek draining the Cauckingburra Swamps. The Cauckingburra Swamps are situated about 2 miles to the N.E. of the north-eastern shore of the lake, separated from the same by a low mudstone and ironstone elevation, which forms the northern continuation of the Salt Mountains, which I shall mention further on. The Cauckingburra Swamps fill out a depression which sends a long, narrowing continuation to the south, at present just dry; a low elevation divides the Swamps in a smaller western and broad eastern part, communicating along the southern end of the ridge. The N.W.-S.E. extension of the Swamps is about 2½-3 miles, S.W.-N.E. about 2 miles. The Swamps dry out in a long drought, as Mr. Craig informed me, completely, but at present they had water in places to 6-7 feet deep, and the highest watermarks were about 18 inches higher. How immense watermasses came down in the big flood from the northern part of the basin proves a fact that the water was about 1 foot high in the humpy, forming at present the new station, although the same is certainly about 12-15 feet above the banks on the creek, and considerable low-lying claypans are to be filled before water can rise so high.

Lake Buchanan is the most imposing of all the lakes on the Dividing plateau, the blue extensive watersheet being unbroken by islands, and with its deep colour permitting the imagniation to forget the shallowness of the basin. Its elevation is about 1,120 feet above the sea level. The water is very pure, of very thin bluish colour, but seen from afar has the wonderful deep blue of the Mediterranean.

along the shore being very shallow, the water produces a grey, bluish tinge on the white clay which forms the bottom. The water is very salty with such comparatively high waterstand, 25 ounces of water evaporated leaving more than $\frac{3}{4}$ ounce of dry deposit, and that mostly pure salt. In long periods of drought, the northern part of the lake gets dry, and only a small watersheet remains in the southern part, which never gets completely dry. At present the depth of water in the northern inlet to the Magga Creek was 5-6 feet, and that is probably also the greatest depth of the northern part of the lake basin, the southern being about twice as deep, if my informations are correct. No fish is known to live in the lake, the perch being the only fish in the tributaries; very tiny shells I found on some sand heaps along the northern inlet. Along the shore, and in and between the lagoons, the salt bushes form usually a very dense thicket; on the elevations wattle shrubs, and in the lowlands the open forest is the prevailing formation. On the north-eastern shore two creeks drain to the lake; the Perch Creek and the Cattle Creek (the latter has its mouth about 1 mile south of the old Yarrowmere Station). Both gather their water from the highest portions of the Dividing Plateau in the north-west from the lake. The Western Divide, about 14-1,500 feet high near Annievale, decreases in elevation, so that where the track from Aberfoyle to Yarrowmere crosses, its elevation would be less than 1,300 feet probably, and then rises quickly to the north, and reaches the highest elevation N.W. from the old station, about 12 miles from the shores of the lake. The highest tops will be about 1,700 feet. The eastern divide reaches the highest elevation to the east from the central part of the lake, probably also near 1,700 feet, then decreases to a deep,broad saddle, through which the Charters Towers main road comes to the lake. To the north-east from the northern end of the lake its elevation would be about 1,500 feet. The watercourses form deep, narrow rocky gorges in the highest parts of the range, but further down their beds become very indistinct, and only a succession of waterholes mark generally the usual direction of the main waterflow; I had the occasion to examine the highest part of the north-western divide, accompanied by Mr. Craig. The foot of the range where the boulders of ironstone first are seen strewn numerously on the surface, and some more or less weathered outcrops occur, is fringed by thriving heartleaved poison-bush growth, which is the greatest enemy of successful cattle and sheep raising in the whole country from the old Bowen Downs Road along the Dyllingo Creek in the south to the Northern Railway in the north. A succession of soft white or reddish mudstones, narrow, hard beds of clinging, deep, red sandstone and

hard ironstone, and silicified conglomerates are seen, and are indicated by the elevation and the character of the soil. In one of the deep gorges in the head of Cattle Creek, about 1,550 feet above the sea level, the following succession is exposed ; uppermost a conglomerate of ironstone and hard silicified boulders about 30 feet thick, then about 1 foot baked, hard, clinging, red, slaty sandstones, and then to the bottom about 15-20 feet soft cross beded mudstone, reddish with yellow and white spots on the fresh surface, hollowed out to cavities (like on the Salt Mountain) by the water and weathering, on old weathered surface hard, red mass about ½-1 inch thick. The position of the starta generally is almost horizontal with localised small wharping. The ironstone and silicified, jasperized beds make the surface very rough and difficult for horses, and numerous more or less sharp boulders being strewn over the surface and the rock outcropping in sharp pinnacle forms, the weathering making the surface honey-combed. The rigdes are covered with lancewood and yellow-jack, the forest in the foot region is poor and suffered very extensively in the big drought, 1900-1.

Salt Mountain.

The low elevation which separates the lower valley of the Mogga Creek and the Cauckingburra Swamps, is a northern continuation of a formerly continuous low plateau, whose most conspicuous and best known remnant is the so-called Salt Mountain. It is a small tabletop ridge, with abrupt precipices almost on all sides, highest in the south (about 70 feet above the surrounding low conutry), lower and narrowing to the north, about 500 yards long from N.N.W. to S.S.E., and 150 yards broad from W.S.W. to E.N.E. along the southern rim. Its distance is about ¾ mile from the lake shore, and 5 miles S.S.E. from the Yarrowmere Station. Three other remnants of the plateau, lower and less known, lie to the N.W. and N. of the Salt Mountain, but being of the same composition and origin, I propose to extend the term "Salt Mountains" to the whole, although the term "mountain" is very disproportionate to the elevation of those flat-topped low elevations. The top strata of the Salt Mountains are silicified and ferruginous conglomerates, weathered into ruiniformous honey-combed boulders prominent especially along the precipitous rim ; the depth of that hard formation, which is responsible for the long resistance to the destructive elements being 10 to 20 feet in places. That very hard cover reposes on a thick mass of soft mudstones, white or yellowish, but interspersed thickly with hardened, red, ferrugineous mass, which in places has the appearance of modules or concretions, which separate easily under the hammer. That formation has under the highest precipices 40 feet thickness

in the exposure, but extends probably deeper, being lower down covered by debris, which frustrates further examination. Those mudstone weather very quickly, and form caves under the overcapping hard conglomerate, whose loose, red, compact boulders, often of enormous size, cover the foot, leaving in places only narrow access to the caves. The most interesting "tafoni" or honeycombed formation prevail also in places on the mudstones, the harder red masses weathering slowly in comparison to the white mudstone. The white mudstone is especially in places along the southern precipice of the original "Salt Mountain," very salty in taste, and lumps of pure salt occur in places filling out small cavities in the formation, or more frequently covered by the sand and debris on the floor of the caves, sheltered from moisture and so preserved from quick solution. Some of those lumps frequently are several pounds in weight. The salt would be occasionally gathered by the residents on the station, but there being other salt beds nearer the same the spot is very seldom visited, and so are very good refuge for dingoes, wallaroos and birds. The disintegration of the soft mudstone is very great, and the destruction of that interesting remnant of formerly extensive ridge very quick. The salt, although very pure, is not found in payable quantities for trading purposes, although the treating of the whole formation for salt would not be without prospect, if the distance from greater settlements would not be so enormous. I am persuaded that without any doubt the high salinity of the lake is due to the solution of the rock salt chiefly. In the northern inlet of the lake or the lowest course of Moggo Creek—the separation being not so easy—layers of salt several inches thick form every year after the water evaporates to a certain extent, and below the upper layer separated by blue, clayey mud from it, is in places a deep layer of salt, which is full of organic matter, and not so good for practical purposes; that layer reposes on a hard ironstone and sandstone bottom. I have been informed that the water on the bottom near the crystallising salt becomes very hot—a phenomenon known very well from other places. Although the season is not favourable, the water being 5 to 6 feet deep and salt mostly soluted by water, I undertook an investigation with a thermometer. The claypans near the inlet were in places just dry, and in small depressions especially in the hoof tracks crystallised good salt occurred in places. I undertook the measurements about 11 o'clock in the forenoon, the temperature in the shade being 78° F., in the sun 86° F. The water 1 foot below the surface had a temperature through the whole profil. I took 75° F., on the sandy ground in the eastern part of the 25 yards broad channel about the same; but on the coarse ground near the

right bank 5 feet deep under the surface the thermometer showed 82.5° F., the difference being felt very distinctly by the bare feet.

From Yarrowmere I proceeded to the N.N.W., crossing some affluents of the Mogga Creek in a distance of about 10, 12 and 15 miles from the Station. The watershed between the Mogga Creek and the Amelia Creek is very indistinct, the elevation being only about 1,250 feet to 1,300 feet. On the western side a comparatively high range proceeds to the north, forming also the watershed between the Amelia Creek—Cape River waters—and the outletless small Webb's Lake.

About seven miles north from Yarrowmere, the creek bed is in gray, fine sandstone, probably the water-bearing stratum. Along the divide in places ironstone outcrops, but as a whole the soil is sandy, and the sand very deep on the northern slope to the Amelia Creek. The poor condition of my horses, and the inaccessability of the Webb's Lake basin, and the country around Lake Moocha further to the north did not permit me to investigate those basins, my time being also limited, and so I proceeded along the Amelia Creek to the Cape River, and reached Pentland on the 11th March, along the big road from Longton.

The information I got about Webb's Lake and Lake Moocha declares both insignificant swamps, drying out in continuous dry seasons. The Lake Moocha is drained probably by the Gorge Creek to the Warrigal Creek and Cape River, so being not without outlet as it appears on the map.

SOME GENERAL REMARKS.

The waterstand in the lakes, whose more or less imperfect description is given in this paper, was at the time of my presence mostly a little higher than at the time the surveyors put their outlines into the maps. The short time available did not permit me to give some more addition to the map, except some comparatively small, but from a geographical standpoint, important statements about the outlet of the Barcoorah Lake basin, and the annulment of the outlet from Lake Galilee.

Some facts concerning the hydrographical character of the country are so interesting, that it seems to be rather important to mention them in a short review of facts. My statements based only on a more or less superficial and hurried investment cannot be considered definite, but before a thorough investigation of the country is undertaken can be of some significance, especially for those who are materially interested in the country I crossed.

The existence of a water-bearing sandstone stratum, bringing permanent springs to the surface wherever it is cut by the same in the southern part of the country investigated, is a very important factor, the springs being a sure refuge for the stock also in a period of heavy, continuous drought, when other superficial supplies fail. The same stratum does not occur or is of much less significance around the western, northern and eastern shore of the Lake Galilee, and also around the Lake Buchanan, although several such horizons are cut in the upper basins of the Carmichael Creek lying between the two lakes.

The water which has been got in bores in the Lake Galilee basin is not good for pactical purposes, being salty, and I doubt that the proposed boring in the Lake Buchanan basin would be satisfactory, it being probable that here, too, the salty rocks extend into a considerable depth.

The springs in the Lake Mueller basin, on the western foot of the range, near old Barcoorah, and probably also some occurring further north along the same foot region, and the springs at Doongmabulla, seem to be products of one more or less continuous and identical weather-bearing horizon, which is tapped by the several subartesian bores on the plateau.

Considering the great and permanent water supply from those two horizons, I believe that the most important intake beds for the artesian water are situated beyond that area, the rainfall in comparison to the tremendous evaporation being hardly sufficient to give much supply also to that deep rich water-bearing horizon. The mentioned bore on Mr. McAuliffe's selection will certainly bring some interesting information about the position and nature of the artesian flow so near the south-west corner of the Dividing Plateau.

It struck me much that on my whole tour I did not strike the deep complex of sandstones which are crossed on the northern line between Warrigal and Burra. Considering the elevation of the range, so far as seen from the railway line, they seem not to extend further than to the Lake Moocha basin in the southerly direction. Lack of their presence devoids the country of many charms, and also difficluties of a peculiarly rugged country, the forms of the lower beds being comparatively the very same, as along the central line between Jericho and Beta.

The desert sandstone formation, so far as I had the occasion to investigate it, is pretty well of the same character along the whole route; but the fact must not be understood, so that the different strata I crossed and described could with some surety be appropriated to the same horizons and looked at as continuous. The usual character

of the continental basins and their deposits speaks strongly against such a supposition, although the causes and the general character of the country were probably more or less the same during the deposition of those strata. For example, the salt-containing rocks, although met in many places, must not be considered as continuous, unless a positive proof is given; it being very improbable that the inland basins in which the deposition occurrred would have been of such an enormous and continuous extent, and that the accumulation of the suspended and soluted material deposited by the water-courses, or in shallow lakes, would be of the same character for a space of some hundred miles of country.

It remains to give some rough estimates of the area without outlet, which is met inside the Dividing Plateau, and the principal recipients of drainage within it

The southern part comprises the drainiage of the Lake Galilee, and the same has an area of about 900 square miles The lake itself, has an area of 90 square miles subtracted by about 11 miles area occupied by the island so as shaped on the map. The greatest length of the lake from the south-west end to the northernmost point of the shore, is about 23 miles, the breadth from the easternmost point of the Big Arm to the opposite western shore in W.N.W. direction, 13 miles.

The northern point of the outletless area comprises the basin of the Lake Buchanan and that of Webb's Lake, supposing that that is really without outlet. The area of the Webb's Lake drainage is completely unknown, but hardly exceeds 100 square miles. The area drained into Lake Buchanan comprises about 1,100 squares miles, the northern and southern part together after those rough estimates covers about 2,100 square miles.

The Lake Buchanan has an area of about 48 square miles, its greatest length is 23½ miles, greatest breadth 6 miles, the average breadth of the main body 4 to 5 miles.

Considering that the highest watermark at the Lake Galilee was about 2½ feet generally above the present level on 22nd March, and that to the time of my visit elapsed about 40 days, the average evaporation was about ¾ of an inch in 24 hours in that sheet of water.

APPENDIX.

In the diagrams, I give the rainfall from the measurement taken at some of the stations on the Dividing Plateau, for January, February and March; April being completely with ut rain in most of the stations. Those for Black Swamp and Yarrowmere are less accurate but they are notwithstanding that good for comparison. I have

got the measurements for 1909 from some stations, but they are in no direct relation to the waterstand produced in the lakes in the time of my tour.

I wish only to remark that the rainfall of the present season from December, 1909, to March, 1910, was much higher than in the whole year from December, 1908, to November, 1909, as the measurements made in Barcoorah and Eastmere prove.

Barcoorah	1/12/1908 to 30/11/1909,	19.85 inches in	30 rainy days.
do.	1/12/1909 to 31/ 3/1910,	21.93 inches in	31 rainy days.
Eastmere	1/12/1908 to 30/11/1909,	21.76 inches in	39 rainy days.
do.	1/12/1909 to 31/ 3/1910,	24.67 inches in	28 rainy days.

RAINFALL IN POINTS.

JANUARY, 1910.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Barcoorah										26		88	19								32									35		200 in 5 days
Eastmere													15	39															54	48	67	223 in 5 days
Black Swamp												162	62								45							70	50			387 in 5 days
Doongmabulla	2												33	50					27			97						7	517	128		884 in 8 days
Yarrowmere	175													50															300	125		650 in 4 days

RAINFALL IN FEBRUARY.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
Barcoorah			12									110							20	12	71	36							261 in 7 days
Eastmere						2						40							23	4	48	34				66			215 in 7 days
Black Swamp											75									50									125
Doongmabulla												45	10						44	18	10	20	8				2		157 in 8 days
Yarrowmere												100							50		50	50							250 in 4 days

RAINFALL IN MARCH.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Barcoorah					80	165					57	16	245	65	15			42	443													1,128 in 9 days
Eastmere						36	31					38	90	165	200			30	748	18	3											1,359 in 10 days
Black Swamp						40					60	37	410	285			25	450	50													1,357 in 8 days
Doongmabulla.. ..							55					43	107	503	97	26		92	838													1,461 in 8 days
Yarrowmere							250						125	300	50		10	200	300	10												1,245 in 8 days

INITIATION CEREMONIES OF SOME QUEENSLAND TRIBES.

By R. H. MATHEWS. L.S.

I shall endeavour to supply a short account of the initiation ceremonies practised by the aboriginal tribes who inhabited a part of Southern Queensland, situated along the coast from the boundary of New South Wales northerly, to the vicinity of Port Curtis, extending inland to comprise a zone from 150 to 200 miles wide. This area contains the country drained by Burnett, Mary, Brisbane, and other rivers, as well as the valley of the Dawson, and upper portion of Condamine River. The native inhabitants of the above territory, had two forms of initiatory rites. The preliminary form was called *Toara*, and the final rite *Bundandaba*. It is intended in the following pages to give a brief report of the principal parts of both these ceremonies. The *Toara* will be described first.

At intervals, during the past decade, I have personally visited the remnants of the tribes at different places within the region indicated, and obtained the following particulars direct from old natives, who had themselves passed through every part of the rites, and had a vivid recollection of all that took place. Part of the information was gained at one time, and part at another, and was supplied by different native informants, whose statements agreed remarkably well. My previous knowledge of the initiation ceremonies of other tribes secured the confidence of the old men, and enabled me to conduct my inquiries more thoroughly than would otherwise have been possible.

The Toara Ceremony.

When the headmen of the tribes consider that there are a sufficient number of youths old enough to be admitted to the status of manhood, messengers are despatched to invite their neighbours, who will probably also have some boys of suitable age, to participate in the

ceremonies. A messenger always has another man with him to keep him company, and help him to obtain food by hunting, because the blacks never like to travel singly. When these messengers arrive near their destination, they paint their bodies with red ochre and grease, in whatever style is customary among their people. They then proceed to the confines of the camp about dusk, where they sit down and commence tapping two boomerangs together, or a boomerang and a throwing stick. When this noise is heard in the camp, all the men give the shout usual on the arrival of a stranger. The messengers again tap with the boomerangs, which is answered as before. They repeat the tapping for the third time, singing a song made for the purpose, and the men proceed some distance towards the messengers and light a fire. A few of the chief men then go and invite them to come up to the fire, where they are smoked by placing green bushes on the burning embers, and standing on the leeward side. The oldest of the men from the camp then addresses the messengers, using the indirect form of speech always adopted in connection with secret matters. "You appear to have found something," to which they assent. "Where did you find it?" is next asked, upon which they state the name of the hunting grounds of their own tribe and proceed to deliver the details of the message, accompanied by the sacred bull-roarer, which is always handed to the headman on these occasions. The headman then communicates the purport of the message to the others, and the news soon spreads through the camp. Next morning, or the day following, the headman sends the message forward by two of his own men to the next tribe, carrying whatever tokens of authority had been sent to him. The two first-mentioned messengers return to their own mob. The same routine is repeated until all the tribes who are expected to attend have been notified.

In summoning the tribe, whose turn it is to act the part of the *poopoon*, as later described, the messenger in addition to the usual tokens of his mission, hands to the headman a small parcel, wrapped in ti-tree bark, consisting of a portion of a feather, or of a porcupine's quill, or a piece of an animal's skin, or the like, and tells him that the other part of it is hidden in the enbankment bounding the *toara* circle.

While the several envoys are away assembling the neighbouring tribes, some of the old men of the local mob, assisted by a batch of their friends, prepare the *toara* ground for the reception of the visitors when they shall arrive. They select a suitable locality in their own territory, near some creek or permanent waterhole, where game and other foods are sufficiently plentiful to support the people while

the ceremonies last. Close to this general camping site, a level spot is chosen, from the surface of which all the grass and loose rubbish are removed. Around this cleared patch small logs and sticks are laid horizontally, in the form of a circle, and are covered with loose earth, making a low wall about 18 inches high. The circular space thus enclosed ranges from 50 to 100 feet in diameter, according to the number of people who are expected to attend, and is called *toara*.

In a secluded position about a quarter or half a mile away, the distance depending upon the character of the country, another round space, called *goondooyoong*, is cleared and enclosed in the same manner. Within this second circle two inverted stumps, called *ngarroo*, resembling those used in the *goonaba* enclosure of the Kamilaroi tribes[1], are inserted in the ground. A small opening is left in the bounding wall of either circle, and a narrow path, called *kunggera*, leads through the forest from one to the other.

On both sides of this path, near the end of it which enters the *goondooyoong*, representations of animals and other devices are formed upon the ground, some consisting of the loose soil, heaped up into the required shape ; whilst others are cut into the turf. Diminutive bark and bough huts are also built on either side of the path, being native camps in miniature. The ornamentation of the ground is collectively called *booraiar*. None of the trees are marked, either at the distal circle, or along the path.

Generally speaking, the same ground was used for many years, being renovated every time a *toara* was held there. The circles were repaired, and fresh *ngarroo*, or inverted stumps inserted in the *goondooyoong*. It should be explained that the gang of men deputed to restore the *toara* do not let their wives or other women know where they are going. The rest of the tribe—men, women, and children—may be camped 20 or 30 miles away, while the repairers are at work at the circles. The reason for only a few men going to the toara ground is in order to prevent the natural food supply from being drawn upon any more than is unavoidable. When the necessary renovations have been carried out, the workers go back to their own mob. By this time the messengers have reached the most distant tribes, and all of them are on the march to the place of meeting. The local mob also start for the toara ground, so that they may be there first, to receive their visitors. Their camp is the initial point, around which subsequent arrivals will take up their quarters on the side facing the district they have come from.

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1. Proc. Roy. Soc. Victoria, vol. IX, N.S., p. 143.

The mustering of the people has been so arranged that the different mobs of visitors shall all turn up at the appointed place within a few days of each other. Practically, the same routine is gone through on the arrival of each lot of strangers, and, therefore, it will be sufficient to give the particulars of one case. When a tribe has got within a day's journey of its destination, a messenger is sent forward to make the announcement, and while he is away they paint and decorate themselves for the occasion. A man from the local mob, whom we shall designate the hosts, goes back with the messenger, and escorts the contingent to the main encampment. He takes care that he does not bring their women and children within view of the *goondooyoong*, or any part of the *booraiar*.

The men of the hosts are sitting down close to the *toara* circle, and the strange men march through the opening in its wall, until they are all within it, and call out where they are from. The women and children turn off to a camping place on the side next their country. The men then come out of the *toara*, and are taken away along the *kunggera* or path to look at the *booraiar* and the *ngarroo*. During the same afternoon, a second or third contingent of visitors may be brought in and welcomed in the same way, their families going into quarters on their own side of the camp. If all the contingents have not arrived, or if there is not time to receive them all on the one day, they are escorted in the next day with the usual formalities. Every night by the camp fires, and every morning, the mothers of the novices sing the customary songs, which are called *kaial*.

When all the visitors have arrived—which is usually the day after the last contingent has been formally received—the time is fixed for taking charge of the novices. Late in the afternoon of that day, when the men return from hunting, they go away along the *kunggera* to the *booraiar* and *goondooyoong*, where the "doctors" of each mob take their turn in standing upon the *ngarroo*, displaying their best feats of juggling. After dark the men come back along the path in single file, carrying pieces of burning bark, and stampede into the ring. The men of each contingent form into a group by themselves, and call out the names of remarkable hills, camping places, and other well-known spots in their respective hunting grounds. The hosts commence this shouting, and the other mobs follow in the order of their arrival. Each group of men then walk to the side of the ring next their country, and lay down their fire-sticks in one heap. Some of the old men of each mob present, now muster the women, novices and children, and bring them close to the ring, where everybody camps for the night, on the side facing

their respective homes. The women, as usual, drone their *kaial* chants for their sons.

At the first streak of daylight next morning, when the little forest birds begin to chirp, a number of men go quietly away to the *goondooyoong*, where they light pieces of bark already prepared for use, and start back along the *kunggera* to the *toara*. The men cast their firebands into the same heaps as on the previous night. The women also step up to the outer margin of the ring, and throw their firebands along with those of their own men, making a number of little fires corresponding to the mobs present. Green bushes are now held over the fires until heated, when the leaves are pulled off in handfuls, and rubbed over the chests, shoulders and limbs of the novices, ostensibly for taking the smell of their mothers' camp off them. They are then placed in groups according to their tribes, and are marched away by the men who have been appointed as their guardians. The women follow them for about 20 or 30 yards, till a number of men rush out of a bushy place, where they have been concealed. They throw a few weapons over the men's heads, and shout at the women to go back. They pretend to run after the women, who retire to the *toara*, and pick up their belongings, which are all ready packed, and start away with some old men who have charge of them.

The novices are taken along the kunggera till out of sight of the *toara*, where they are allowed to sit down. The guardians say to them, "Your mothers are calling you, run off to them," pointing in a certain direction in the rear. The boys jump up and run in the direction indicated for a short distance until they are met by a lot of armed men, who were hidden in the scrub or long grass, and are brought back. Each novice is now given into the keeping of the man who has been chosen to act as his guardian during the ceremony. This man belongs to a different mob to the one the boy is a member of. A band of men called *koorbeengoor*, have been chosen from each of the contingents present. Their duty is to take the novices with their guardians away into the bush, and carry out all the pantomimic and other performances which constitute the ritual of the initiation ceremonies.[1]

The lads, with their heads bowed towards their breasts, are taken along the track to the *buraiar*, and at each object represented they are told to raise their eyes and look at it. Here a *kundeer*, a clever man or doctor, is seen pretending to fight with an image in human shape, made of wood and clay, with grass fastened on it for hair.

1. Compare with the *kooringal* of the Kamilaroi Tribe during the *Bora* ceremony. Proc. Roy. Soc. Victoria, vol. 9, N.S., p. 151.

This wooden man is called *Birwa*, because he is supposed to come from Birwa, the native name of one of the Glass House Mountains. The *kundeer* vanquishes the image, and carries it away into the bush close by. A man is climbing a tree with a vine, which he swings round the bole, and holds one end with his left hand, the other end being twisted round his right leg, and held by his big toe. He has his feet against the tree, and pretends to chop out a bee's nest. A *kundeer* sneaks round to the other side of the tree, and cuts the vine with a chop of his tomahawk, and lets the man fall to the ground. He is supposed to have been killed by the fall, and is carried away and placed with the image.

The novices are next conducted to the entrance of the *goondooyoong*, and see a *kundeer* standing on the top of each *ngarroo*. These clever fellows are pulling string out of their navels, ears or other parts of their bodies. They bring up a quartz crystal, called *kundeer* out of their insides, and spit it into their hands, which they hold up to public view. Several other tricks are shown, after which the *ngarroo* stumps are pulled out of the ground. Some strong men catch hold of the stem, and sway them from side to side to loosen their hold in the soil, the *kundeer* men sometimes remaining upon them till they come out. The *ngarroo* are then chopped up and burnt by men who remain behind for the purpose.

The *koorbeengoor*, guardians and novices now leave the *goondooyoong*, and start off into the bush. The heads of the novices are bent down, and they are told to look only at the ground in front. They are forbidden to look at the sky, because water, the rain, comes from there. When a watercourse is reached, although dry at the time, they are taken on the men's shoulders and carried over it. They are also carried over swampy ground when it crosses their line of march. In the afternoon a camping place is reached, where a screen of boughs, in the shape of a crescent is erected for the lads to stay in during the night, to protect them from the wind. Leaves are strewn thickly on the ground for them to lie upon. Fires are lit on the open side, at which the guardians likewise camp.

The *koorbeengoor* take up a position a little way from the convex side of the bough shelter, where they have several fires, and after dark the boys are brought out by their guardians to witness a play. As these performances in the bush are all of the same character, it will be sufficient to say that the actors represent different animals or scenes from the daily life. Sometimes the curlew is selected, the men painting like that bird, and imitating its cry. Another performance mimics the iguana ; another the flying fox, with some men hanging in a bunch from the branch of a tree. At other times

they imitate the emu, the wonga pigeon, a kangaroo hunt, and so on. At the conclusion of each evening's performance the novices are put back into their own sleeping place.

A fresh camping place, more or less distant from the preceding one, is reached every night. This moving about into different hunting grounds is adopted to enable the men to obtain a sufficient supply of food. Sometimes, it is found necessary for detachments of men to diverge several miles in another direction to that along which the novices are taken, for the purpose of hunting for game to replenish the cammon larder. The novices receive a limited allowance of the best food, which is put into their mouth from the guardians' hand, or on the end of a small stick. The lads are not allowed to handle their food, or do anything for themselves. If they want anything they must make signs to their sponsors.

We shall now digress for a few minutes, to describe what became of the women. As already stated, they were sent away from the *toara* on the morning the boys were taken away from them. They were accompanied by a few men, who were deputed to take charge of them, and direct them as to what part of the country they should travel into. The women of each contingent keep a little way apart from the others, and when evening comes they pitch their camps, each mob of women and children selecting the quarter which is in the direction of their home. During the evening the mothers sing their *kaial* songs, each group of mothers having their own chants for their sons. These songs are also repeated every morning at daylight.

The custodians of these women are kept conversant with the movements of the *koorbeengoor*, who are in charge of their sons. Messengers frequently go to and fro between them in order to prevent them overlapping each other's tracks. When the *koorbeengoor* and guardians are travelling from one camp to another, they spread out over a strip of country about a mile or more in width, so that they can hunt for food as they go along. The outside wing of this hunting party, next to the side on which the women are known to be, occasionally shout hoh! yuah! wayau! dirrau! When the women hear any of the *koorbeengoor* party shouting, they swerve a little out of their course, so as to avoid them. This is continued day by day, so that the women are always camped within a few miles of the men who have charge of the boys. The final camp of the women is the place which has been fixed upon for bringing the novices back, and is called *bunyunggan*.

There is another matter which can be introduced here. It was stated in the beginning of this paper that the messengers summoned

the *poopoon*[1], which is the name given to any tribe chosen to appear on the scene, when the novices have passed through a sufficient course of instruction in the bush with the *koorbeengoor*. The *poopoon* do not come to the *toara* ground at the same time as the other invited tribes. They have, however, reached a place perhaps 20 or 30 miles distant, where they are ready waiting. The morning on which the novices were taken away from the main camp, as already detailed, another pair of messengers were despatched to the *poopoon*, apprising them of the fact and escorting them in. They search around the boundary of the circle for the other part of the token which had been sent to them in the beginning. Upon finding it they run away along the *kunggera*, through the *booraiar* to the *goondooyoong*, inside of which they dance round. One of the old men calls out, "I have found a spear," if the token were part of a porcupine's quill; whatever the token is, the finder gives some farciful description of it.

The messenger then pilots the *poopoon* mob and their wives to the locality where they have to meet the *koorbeengoor* by and by, and they make a camp there. About half a mile from the camp, towards the point of the compass from which the *koorbeengoor* will advance, the poopoon men go and make a fire, consisting of a curved line of burning sticks, extending about 10 or 15 yards or more, the concave side of the line of fire being towards the poopoon's camp. This fire is distinguished as the *wommaran*. The same locality is used for many years by the local mob, at which to meet the tribe whose turn it is to act the part of *poopoon*.

Having now made the reader acquainted with the whereabouts of the women, and also of the *poopoon*, we shall return to where we left the novices a page or two back. During the day they are taken out hunting with the men, but are not allowed to capture anything. If they see a kangaroo, snake, or other animal, they must make signs to the men. They are not permitted to speak, and must not look towards any part of the sky. They must keep their hands constantly shut, and in warm weather the perspiration accumulates in their palms and insides of their fingers, and gets fly-blown. The guardians open the boys hands, and wipe the insects off, placing a boomerang or other weapon in each hand, which they must carry, thus protecting the inside of their hands from the annoyance of the flies. The travelling stages are so arranged, that the last night's camp shall be within a few miles of the place settled upon for meeting the *poopoon*. The proceedings in the bush may last some days, or the best part of a week.

1. Compare with the *beegay* of the Kamilaroi tribe. Proc. Roy. Soc., Victoria, vol. 9, N.S., p. 167.

Early in forenoon of the day following the last of the nightly performances, two old men approach the *koorbeengoor* party, who are resting in the bush, and tap two boomerangs together, similarly to the procedure described in regard to the messengers in an earlier page. These men have come from the *poopoon* mob for the purpose of notifying that they are ready to meet the bush contingent. Some of the leading men of the *koorbeengoor* go over and parley with them for awhile, after which the two men go away.

Later in the same day the novices are taken into a place where there is long grass, or a patch of scrub, or where the ground is naturally broken into a deep, dry gully, and all hands sit down. A few long drawn whistles, accompanied by the tapping noise, are heard close at hand. The *koorbeengoor* say "Hullo, there must be somebody here!" The whistling is again heard, and the *koorbeengoor* gather their spears, but the novices are not armed, and all of them march quickly in that direction. A few strange men in their war-paint now show themselves, and the *koorbeengoor* and guardians call out, "There they are!" The strange men then run away for half a mile or a mile, according to whether the ground is scrubby or open, and join their own party.

The *koorbeengoor,* whom I shall for convenience call the "bush mob," with novices in the rear, pursue the fugitives with their spears in their hands ready for action, and soon arrive at the meeting place, where they see the *poopoon* standing armed with spears behind the *wommaran* fire[1]. When the bush mob get within 30 or 40 yards, the *poopoon* step towards them and cast several spears, which causes them to retrace their steps a little way. Recovering themselves, they charge the *poopoon,* throwing some weapons, and drive the latter back beyond the *wommaran.* The *poopoon* again face their opponents with spears and waddies, and force them to retreat. The bush mob rally, and make another assault upon the *poopoon,* who retire from the field and go back to their camp. This is merely a sham fight, and must always result in a victory for the men who have charge of the novices.

While the *poopoon* are going away, the guardians, novices and *koorbeengoor* come up to the *wommaran* fire, and scatter the embers with their feet. They then go into quarters for the night in a thickly timbered place close at hand. By this time it is near sunset, and the novices are put standing in a row, while some men swing a *bundur-bundur,* or large bull-roarer several yards in the rear of them. The novices are told to turn round and look at the men.

1. Compare with the *buddhamoor,* or ring of fire, of the Kamilaroi. *Op. cit.,* p. 170.

and at the same time are cautioned not to mention this instrument, or any of the scenes which they have participated in while away in the bush, to the uninitiated on pain of death. Each novice is cautioned separately, with a good deal of formality, and consequently the ceremony lasts some time.

From this time onwards the novices are at liberty to converse with their comrades, and can raise their heads and look in any direction they please. They are also released from keeping their hands shut, and all other restrictions placed upon them when first taken charge of by the men. This finishes the day's programme. and everybody retires for the night.

Early next morning, in the vicinity of the camp, some men climb trees, in which the top foliage is sufficiently dense to hide them, and shout in a clear, weird voice. The men represent the Deawai and Kappaian groups; the men of the former occupy trees on one side of the camp, and the latter ascend trees in the opposite direction. Several other men sit in a cleared piece of ground, the surface of which they beat with strips of bark held in the hand, and in this way make a considerable noise. Every novice is brought out in rotation by his guardian, and after some deliberation among his kinsfolk, he receives a new name, by which he shall thenceforth be known to his fellows. As each boy is named, all the men give a shout, which is answered by the men in the tops of the nearby trees, giving the novices the impression that ancestral spirits are hovering about in the air. When a Deawai boy is named, the men of that division up in the trees, imitate the noise made by his totem, or that of some of his relatives, as the trumpeting of an emu, the song of a locust, the howling of a dingo, and so on[1]. A Kappaian boy is next led forward and named, and the men in the trees on the opposite side of the camp imitate certain totemic animals. The headmen say to one another, " Those ghosts have flown over there now, indicating a certain direction with the hand, to make the boys believe that the noise emanates every time from the same individuals, who pass through the air unseen from one side of the camp to the other.

At the conclusion of the naming ceremony, the novices were greased and painted, and arranged in the following regalia of a man. A girdle, *mookanba*; a wide brow-band, *kumban*; a cord passing diagonally over the shoulders and chest, re-crossing itself at the front and back, called *wanggin*; a neck-lace, *dyoo-leen*, with shells attached; four narrow kilts, *goonyer*, one in front, one behind, and one on either side. The hair of the head was decorated with bright

1. Compare with similar procedure at the Kamilaroi *Bora* ceremonies. Journ. Anthrop. Inst., vol. 25, pp. 336-337.

plumage of birds. When the boys were dressed, a start was made for the *bunyungga* or women's camp, which was probably two or three miles distant. Messengers had been despatched in the early morning to inform the mothers that their sons would be brought back in the afternoon, so that preparations for their reception could be made.

When all was ready, an old man started on ahead, carrying his weapons, towards the women's camp, and was followed by the rest of the "bush mob." The mothers assembled in the clear space near the *bunyungga*, and the boys formed a circle around them. Each mother held out her yamstick, with a bunch of small leafy twigs tied to the distal end, and tapped her son on the chest and shoulders with it. He caught hold of the leaves and pulled them off, placing them under his armpits. The novices are then passed through a dense smoke, by placing green boughs on fires which have been kindled for the purpose, each group of boys being smoked by their own people. When the lads come out of the smoke they go away with their friends to a camp near the single men's quarters, where they remain for the night. All the men of the bush mob are smoked by their women in the same manner as the boys.

Next morning the *koorbeengoor* guardians and novices go out into the bush, and again meet the *poopoon*, close to where they met them before. All the men are armed, and on this occasion the novices also carry spears, and other weapons of a lighter make than those used by the men. In addition to the ordinary painting, the boys wear small, leafy twigs in their girdles. The *poopoon* and the bush mob advance upon each other till within spear range. The former commence by throwing a few spears at the novices, who parry them with their shields; and in their turn cast some spears at the *poopoon*. When a novice makes a good throw, and also every time he dexterously turns off a spear with his shield, he is applauded by the men of the *poopoon*, as well as by his own people. This "practice" goes on for some time, when the novices fall back behind the men, and watch the spear throwing on both sides.

Although only sham fighting, a man sometimes got killed in these encounters. In European engagements, blank cartridges are used, but when the aborigines have a sham fight they must use the identical weapons as in actual warfare, and, consequently, accidents would be likely to happen, even with care. But if a man had a blood feud against another of the opposing side, he might take advantage of his opportunity to kill him. In the event of a casualty of this sort the fight would cease; but if all went well, it would continue till near sun-down.

These ceremonial encounters with the *poopoon* sometimes lasted two or three days, and when they were concluded the visiting tribes broke up and returned to their respective hunting grounds, taking their own batch of novices with them. Before starting away, however, the headmen of each contingent met and discussed suggestions for the next *toara* meeting. The custom was that the people who were the *poopoon* at one *toara* should be the hosts at the next, and that one of the other mobs should take the duty of being *poopoon*. The hosts always had a *toara* ground in their own territory, and the mob who resided farthest away from that place was usually chosen as the *poopoon*.

The Bundandaba Ceremony.

Every novitiate who graduates by means of the *toara* is required to pass through a further ceremony, called *Bundandaba*, before he can take his place as a man of his tribe. The following is a very much curtailed account of it.

In about six months or a year after the *toara* ceremony, preparations are made for putting the candidates through the final rite. The whole community need not be summoned, but it is sufficient to invite the initiated men of one or more of the surrounding tribes. This is done by means of messengers in the usual way, appointing the time and place of meeting. The local mob—that is, the people who sent the invitations—in due time, repair towards the place agreed upon, but no circle or ornamented ground is required. The people who have been invited, also journey to the appointed tryst, and meet each other before they present themselves to the hosts. The messengers have so arranged matters that the different mobs get within a few miles of each other on the same day. The visitors are conducted by the messengers to a common camping ground, each mob locating themselves on the side next the place they have come from. That evening some of the principal men of each contingent start off to the camp of the hosts, which they make a point of reaching an hour or two after dark. On coming in sight of the camp fires they sit down and tap their boomerangs, or other weapons together, accompanying this with singing. The men in the local camp give a shout of welcome, but remain where they are. The strangers do not approach any nearer, and in a short time they clap their hands as a signal that they are going away.

Next morning, the fathers, uncles and other relatives of the novitiates gather them up out of the camp, and after appointing a guardian for each, they go over and find the place where the strangers were sitting the night before. They now bend down the heads of the novices, and proceed along the men's tracks for about a couple

of miles, where they come to a row of men lying on the ground side by side, their feet being towards the men who are approaching. A headman of the Barrang section is standing at one end of the prostrate row, and at the other end a Balgoin man is standing. These men represent the Kappaian cycle, which will be explained at the end of this paper. A guardian takes a novice who is a Barrang by the arm, and they both go up in front of one of the erect figures—the Barrang man—but owing to the novice's head being bowed upon his breast, he sees nothing just at first. The guardian slightly raises the boy's head, saying, "Look at the man's feet!" The guardian moves his head a little higher, and he sees up to the man's waist. He pulls the youth's head up quite straight, and then he observes the whole of the man in front of him, who is standing quite still. The guardian then gives the youth a piece of stick, picked up off the ground, and tells him to throw it at the Barrang man's chest. He does so, and the man pretends to fall back dead.

Another guardian takes a Balgoin novice and leads him to the other end of the row, where the Balgoin headman is standing. He raises the youth's head till he sees successively the feet, the waist, and the entire figure. The guardian then gives him a piece of stick, which he throws as directed, and the Balgoin man falls on his back apparently dead. The guardians then say to the two novices in question, "You have killed those two great men; you are bad boys, and will, perhaps, marry wrong women." The row of men then rise to their feet jumping and singing before the novices, the heads of all of whom have been straightened up.

The combined contingent of *koorbeengoor* and strangers now go away through the bush hunting for food. The novitiates are brought along by their guardians, and at midday are placed lying down on the ground, where they must remain silent. Late in the afternoon, a camping place is reached, where the youths are put into a bough enclosure by themselves, and are fed. At night by the camp fires the *koorbeengoor* perform an obscene dance, as follows: A man stands in a slightly stooping posture with his hands clutching his genitalia; another man in the same attitude stands behind him at the distance of about a couple of feet, and so on, until perhaps a score of men are all standing in a line, one behind the other. The first man, followed by the others in single file, tramps along in front of the camp fires, moving his loins as in the act of copulating. The novices have been placed sitting down, so that they can have a good view of these men filing past between them and the light of the fires, every man going through the same gestures. When they have gone past into the darkness on one side, they turn round and come back in

the same order to the other side. This dance, which is called *toongbirraman*, is kept up for half an hour or more, after which all the party go to sleep.

Next morning after breakfast, the youths are brought out of their yard again, and the *toongbirraman* is repeated for a short time. All hands now leave the camp, hunting as they go, till mid-day, when a halt is made to cook such game as may have been caught. In the meantime, the novices are treated to another exhibition of the *toongbirraman* dance. They go forward hunting till near sundown to a new camp, and that night the men play at wrestling. Before commencing the two combatants rub ashes from the camp fire on their hands to enable them to grasp each other's greasy skins. They do not use their feet to trip one another like white men do in this exercise. At first there is only one pair of wrestlers at a time, but towards the finish, several couples may join in. After the wrestling, one or more pairs of men may engage in fighting with clubs and shields. The evening's programme terminates with singing and beating time.

Next morning the *toongbirraman* is again enacted, after which the novices are put lying down, and are covered with rugs or bushes. Presently, they hear the sound of the *bundandaba* or small bullroarer coming nearer and nearer. The guardians say, "Here they come! They will eat you!" and help the boys to their feet. Within about twenty yards, two headmen, a Bunda and a Dyerwain, representing the Deawai cycle, are standing swinging the implement. It is tied to the end of a string about three feet long, which is fastened on the thin end of a pliable rod which serves as a handle; and it is used in the same way as the *moonibear* amongst the Wirraidyuri tribes[1]. The *bundandaba* is rubbed on the penis, navel, and under the arms of each novice, and he is cautioned never to divulge this secret to any person who has not passed through the necessary ceremonies. A bundle of *bundandabas*, equal in number to the novices, is now produced, and an instrument is given to everyone, being again warned to keep it out of reach of the uninitiated.

It may be explained here, that of the two old men, Barrang and Balgoin, supposed to have been killed by the novices, had instead belonged to the Bunda and Dyerwain sections, then in that case the two old men who exhibited the *bundandaba*, would have been Barrang and Balgoin. In other words, if the men of the Kuppaian cycle discharge the first function, then the men of the Deawai cycle must exhibit the bull-roarer, and vice versa.

1. Journ. Anthrop. Inst., vol. XXV, p. 298, Plate 26, Fig. 39.

This important business being over, the novitiates are greased and dressed, after which they are marched away to the *bunyunggan* or woman's camp, with the same ceremonial described in dealing with the *toara* in earlier pages. During the afternoon, the *koorbeengoor*, novices and guardians go to meet a strange mob of men, who have come to act the part of *poopoon*, and there is a sham fight, in which the novices, as newly admitted men, are entitled to participate. It often happened that the *poopoon* mob had some junior recruits of their own, admitted at a *Bundandaba* held in another tribe's territory. In such a case the two lots of fresh men were opposed to each other, while the elder warriors looked on and applauded. When the novices had finished, the men of maturer years engaged in the contest. If a man or a youth were killed in these encounters, by accident or design, the body was eaten; the same course was followed in the event of more than one casualty.

This finishes the *Bundandaba*, and the visitors disperse to their own homes, as already particularised in regard to the *Toara*. If the novices are old enough, they are now entitled to claim their promised wives, but this matter is regulated by the old men. The candidate for a spouse must have acquired a man's voice, and have a sufficiently developed beard.

In the foregoing pages mention has incidentally been made of the social divisions, De-a-wai and Kap-pai-an, and their connexion with the initiatory rites, so that a brief explanation of them becomes necessary. The people collectively are divided into two primary cycles or groups, Deawai and Kappaian; the former is again divided into two sections, called Dyerwain and Bunda, and the latter into two, called Barrang and Balgoin. The feminines of the cycles and sections are made by means of the suffix *gan*. The following table will make the matter clear:—

Cycle	Wife	Husband	Son	Daughter
Deawai	Dwerwaingan	Balgoin	Bunda	Bundagan
	Bundagan	Barrang	Dyerwain	Dyerwaingan
Kappaian	Barrangan	Bunda	Balgoin	Balgoingan
	Balgoingan	Dyerwain	Barrang	Barrangan

Each cycle has perpetual succession through its women, *e.g.*, Dyerwaingan has a daughter Bundagan, and in the next generation Bundagan has a daughter Dyerwaingan, and so on alternately for ever. Moreover, as the totems, called by the natives *moorang*, descend through the women, it necessarily follows that they must belong to both sections of the cycle. A man or woman may have more than one *moorang* or totem, but they are inherited from the mother, and the mother's mother.

Although marriages are mostly regulated by the above table, they are not restricted to it. For example, taking Balgoin, the first name in the "Husband column," he marries Dyerwaingan, but his marriage with a Balgoingan is also qutie lawful. In other words, a man can marry a woman of his own cycle and of his own section, proving that there is no absolute law of exogamy in force among any of the tribes dealt with.

Among the natives of Burnett, Mary and Dawson Rivers, the common bat, *deering*, was the friend of all the men, while a small owl or night hawk, *boorookapkap*, was the friend of the women. Mr. T. Petrie reports that the blacks of Brisbane River believed that the bat, there called *billing*, made all their men folk, and that the *wamankan*, or night hawk, made the women[1]. In 1834, 76 years ago, Rev. L. E. Threlkeld reported that the tribes at Lake Macquarie, New South Wales, had a belief that a certain small bird was the first maker of women, and that the bat was venerated on the same grounds by the men[2]. Mr. James Dawson, in 1881, describing the customs and beliefs of the aborigines of the western part of Victoria, states that the bat belonged to the men, and the fern-owl to the women[3].

A straight line from Port Curtis to Lake Macquarie is about 650 miles, and a line from Lake Macquarie to Portland in Victoria, is about another 650, making 1,300 miles in all. Or, if we take a line direct from Port Curtis to Portland, the distance is over 1,100 miles. The prominent position assigned to the bat in places so remote from each other, should be borne in mind when considering the problem of the original peopling of Australia.

Conclusion.

Nothing was known of the *toara* ceremony until 1900, when I published a short account of such portions of it as gathered by me from the natives up to that time[4]. Personal inquiries among the remnants of the tribes since that date have enabled me to collect many new and important details respecting the *toara* rites.

The first and only notice of the *bundandaba* ceremony, hitherto published, is a brief report furnished by me to the Anthropological Society of Vienna in 1909[5].

1. Reminiscences, p. 62.
2. An Australian Language, p. 49.
3. Aborigines of Victoria, pp. 52-53.
4. American Anthropologist, vol. 2, N.S., pp. 139-144.
5. Mitteilungen der Anthropologischen Gesellschaft in Wien, Band 40, pp. 44-47.

CORRECTION.

In my paper on "Burial and Other Rites," in volume 24 of this Journal, page 72, line 8, for "$1\frac{3}{8}$" *read*, $1\frac{1}{2}$; and in the next line, for "more" *read* "less."

NOTES ON SOME TRIBES OF WESTERN AUSTRALIA.[1]

By R. H. MATHEWS, L.S.

Western Australia contains an estimated area of 978,299 square miles, or, inclusive of the contiguous islands, about 1,057,250 square miles, being about eight times the size of Great Britain. It is the largest of all the States of Australia, containing more than a third of the entire area of that continent. In the south-west coastal district, there is much land suitable for farming operations, and farther north there are extensive grassy downs, capable of depasturing immense numbers of sheep and cattle. Considerable areas are gold-producing, chief among which may be mentioned Kalgoorlie, Cue, Marble Bar and Kimberley—comparable in extent to some prominent European kingdoms. By far the greater portion of the State, however, consists of vast arid tracts of sand and scrub, which is practically a desert.

In this monograph, I shall endeavour to give the reader a short account of the customs of some of the aboriginal tribes of Western Australia, supplied to me by trustworthy correspondents throughout the State. The article is divided under the following sub-headings: Language, Sociology, Folklore, Customs and Superstitions, Boy Companions for men. The accompanying map will enable the reader to trace out at a glance, the geographic region to which every one of these parts of the subject belongs.

* NOTE.—The appendix to this paper deals with certain customs of the tribe therein referred to and is not printed but will be held as a record of the Society, the information being available to scientific bodies and scientists on application.—ED.

LANGUAGE.

In 1907 I published an elementary grammar and vocabulary of the language spoken by the Loritya[1] and adjoining tribes, located on both sides of the boundary between South Australia and Western Australia, from Blyth and Tomkinson Ranges to Lake Macdonald, reaching also into South Australia a considerable distance. The only other grammar of any of the dialects of Western Australia, is that prepared by Mr. Charles Symmons, which was published as an appendix to the Western Australian Almanac for 1842. It dealt with the tribes of the Perth district, but I have ascertained that the language was practically the same as far south as King George's Sound, and that it also extended north from Perth about 150 miles or farther.

I have very much condensed and re-arranged, Mr. Symmons's text, with some additional information gained from my correspondents. It is gratifying to me to revive interest in a subject which has lain in abeyance for nearly 70 years.

If we compare the present vocabulary with the one I published of the Erlistoun language[2], we find that eleven of the words are the same, and six closely similar. In 1903 I published a vocabulary of the Roebourne dialect[3]; in comparing that vocabulary with the the present, it is seen that thirteen words are the same. Comparing Roebourne vocabulary with that of Erlistoun, we find that seven of the words are identical and two similar. Then, if we examine my Erlistoun and Loritya vocabularies, it is found that thirty of the words are the same, or practically the same, whilst eight others are very similar. That is, more than a third of the Erlistoun are the same as the corresponding words in the Loritya.

In order to realise the geographic range of these dialects, let us start at Esperance Bay, and follow the coast northerly to Roebourne; thence an arbitrary line to Lake Macdonald on the South Australian boundary; thence to Blyth Ranges, and thence via Menzies back to Esperance Bay. The area included in this description represents more than half the territory of Western Australia. In comparing the above-mentioned vocabularies, it has been observed that several of the words are the same throughout this vast region. Moreover, the fundamental elements of the grammar of the Loritya and Perth dialects are substantially the same—a distance of more than 80 miles in a direct line.

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(1) Proc. Amer. Philos. Soc., vol. xlvi, pp. 362-368.
(2) Proc. Amer. Philos. Soc., vol. xlvi, pp. 365-368.
(3) Queensland Geographical Journal, vol. xix, pp. 69-70.

ARTICLES.

The place of the English Article is supplied by the various forms of the demonstratives representing "this" and "that." The English adverb, "here," in its several native forms is frequently treated as a demonstrative.

NOUNS.

Nouns have number, gender and case.

Number.—There are three numbers, the singular, dual and plural. Yago, a woman ; Yago-gurdar, a pair of women ; Yagoman, several women. The suffix *man* is a contraction of *manda*, all. Words ending in a consonant are said to take *arra* or *garra*, meaning "again" or "others" ; as, gulang, a child ; Gulungarra, several children.

Gender.—Different words are used to distinguish the sex of the human subject, as Yago, a woman ; Mamarap, a man ; Gulang, a child of either sex. For animals, words meaning "male" and "female" are employed.

Case. The cases are indicated by inflexions. The principal cases are the nominative, causative, genitive, instrumental, dative and ablative.

The nominative merely names the subject at rest. As durda, a dog ; yangor, a kangaroo.

Causative. This represents the subject in action, and is connected with a transitive verb, as Yago-al budyor bianaga, a woman the ground dug.

Instrumental. This case takes the same affix as the causative. Ngadjo boat-al Perth-ak bardaga, I in-a-boat Perth-to went. Durda gun-al bumaga, a dog the gun-by was killed or a dog was killed by the gun.

Genitive. The genitive takes the affix *ak*, as yago-ak wanna, a woman's yam-stick. Mamarap-ak giddyi, a man's spear. Kumal-ak garrab, an opossum's hole or nest.

There are inflexions denoting the dative and ablative cases, but the samples to hand are not sufficiently definite.

ADJECTIVES.

Adjectives follow the qualified nouns, and are similarly declined. Comparison is generally effected by a reduplication, and the superlative is formed by the addition of the intensive particle *dyil*. Gwabba, good ; gwabba-gwabba, very good ; gwabba-dyil, best.

PRONOUNS.

Pronouns are inflected by number and case, but are without gender. There are two distinctive forms of the first person of the dual and plural, depending upon whether the individual addressed is included or excluded[1]. Again, there is a set of nominative pronouns for use with transitive verbs, and another set for use with intransitive verbs. These sets are, however, confined to the first and second persons of the singular number, and are not found in the dual and plural.

		Transitive.	Intransitive.
Singular	I	Ngadjo	Nganya
	Thou	Nyundo	Nginni
	He	Bal	

I have omitted the pronouns in the dual and plural, because the information yet to hand is not sufficiently explicit. They are, however, the same in principal as those of the Loritya language, the pronouns of which are as follows :—

Singular	1st Person	I	Ngaiulu
	2nd Person	Thou	Nuntu
	3rd Person	He	Paluru
Dual	1st Person	We, inclusive	Nuntungali
		We, exclusive	Ngali
	2nd Person	You	Numbali
	3rd Person	They	Palumkutara
Plural	1st Person	We, inclusive	Nguntunganana
		We, exclusive	Nganana
	2nd Person	You	Ngurangari
	3rd Person	They	Tana

There are also forms of the pronouns signifying "with me," "for me," "towards me," and other modifications to meet different shades of meaning. The pronouns of the third person frequently take the place of demonstratives in all the numbers; a fact which accounts for the great diversity of these pronouns, which have little or no etymological connection with the others.

Demonstratives.—The demonstratives in this language, by the combination of simple root words, can be made to indicate position, distance, number, etc. That, nyagga. This, niddya. That (is it),

1. I was the first author to report the "inclusive" and "exclusive" forms of the first personal pronouns in the dual and plural in the languages of Western Australia. Queensland Geographical Journal, vol. xix, p. 67. Proc. Amer. Philos. Soc., vol. xlvi., p. 363.

alli. Belonging to that, alluk. This way, wunno. Here, yual. Just there, alganya nyering. Here, in-yene. There, inyanyellung. That very one, nyagabal.

Interrogatives.—Who, nganni ? Who (did it), ngando ? Who (will do it), ngandyal. Whose, ngannong ? What (did it), yanman ? What for, yannung ? Where, winjee or winjal ? Is it so, kanna ? Which way, injal ngwarroo ? Why, na-it-jak ?

VERBS.

Verbs have the singular, dual and plural numbers.

There is a form for each tense of the verb, as bumawin, beats ; bumaga, did beat ; bumadyul, will beat. Any person and number can be expressed by using the proper pronoun from the table given in an earlier page.

The following is a short conjugation of the verb, *buma*, to beat or kill. An example in the first person of each tense in the indicative mood will be sufficient.

Present	Ngadyo bumawin, I beat now, or am beating.
Past	Ngadyo bumaga, I did beat. Ngadyo gori bumaga, I beat just now. Ngadyo karamb bumaga, I beat a short time ago.
Future	Ngadyul bumadyul, I shall beat. Ngadyul burda bumadyul, I shall beat presently. Ngadyul mila bumadyul, I shall beat by and by.

There are conditional reflexive and reciprocal moods, similar to those shown in my grammar of the Wiraidyuri language[1].

ADVERBS.

The following are a few of the most commonly used adverbs :—

Of Time.—Now or to-day, yai-i. Tomorrow, binang. Yesterday, mar-rok. Day before yesterday, maira-jain. Immediately, ilak or gwai-titch. Formerly, karamb. Soon, burda. Lately, gori. Long ago, gorah.

Of Place.—Here, inyone, yual and nyal. There, yellinya. There, farther, boko. Yonder, bokoja. Where, winyi. Before or first, gorijat. Behind, ngolanga. Last, yuttok. Near or close, bardak. That way, wunno. Here (in this place), nidjak.

Of Quantity.—How many, ngamman. More, ngatti ngatti. Enough, belak. So many, winnir.

(1) Journ. Anthrop. Inst., xxxiv pp. 284.

Of Affirmation and negation.—Yes, Kwa or Kai-a. No, yuada. Never, yuatjil. Not, bart or bru. Nothing, arda.

Perhaps, gabbain. Then, garro. Indeed, bundojil. Always, do-wir. Between, kardagor. Together, danjo. Apart of separate, wallak-wallak. Below, ngardagan. Above, yiragan.

PREPOSITIONS.

These are always placed after the noun or pronoun. Without, bru. With, gambarn. Among, manda, Within or in, bura. On or upon, ngadja. After, ngolang.

CONJUNCTIONS AND INTERJECTIONS.

And or also, gudyir or wen. If, minning. Or, ka. Alas! nyon.

NUMERALS.

One gain. Two, gudyal. Five, marjinbangga, meaning a hand. Ten, belli-belli marjinbangga, the hand on either side, or both hands.

VOCABULARY.

The following list of 220 words has been selected and re-arranged from the vocabularies prepared by Charles Symmons, Captain George Grey, G. F. Moore and Rev. J. Brady, all published between the years 1840 and 1845. I have thought that placing groups of words of the same character, together under distinctive headings, will prove more acceptable for reference than the common method of arranging the vocabulary alphabetically.

The Family.

A man	mammarap	Mother-in-law	mangat
Old man	windo	A woman	yago
Sorcerer	boylyagadak	A widow	yenang
Medicine-man	mulgar	Old woman	windo
Youth	gulambiddi	Girl	bun-garn
Elder brother	nguban	Child	gulang
Young brother	guloain	Elder sister	jindam
Father	mamman	Younger sister	guloain
Mother	ngangan	Infant	gudja

The Human Body.

Head	katta	Beard	nganga
Forehead	bigaitch	Eye	mel
Hair of Head	kattamangara	Eyebrow	mimbat

Nose	mulya	Shoulder	munga
Ear	twank	Thigh	dtowal
Mouth	dta	Knee	bonnit
Teeth	nalgo	Foot	jinna
Mammae	bibi	Heel	ngardo
Umbilicus	nanna	Fat	bo-ain
Abdomen	kobbalo	Flesh	il-ain
Tongue	dtallang	Bone	kotye
Chin	nganga	Penis	merda
Back	bogal	Sorotum	yadjo
Forearm	marga	Vulva	babalya
Hand	marra	Urine	gumbu
Elbow	nogait		

Inanimate Nature.

Sun	ngan-ga	Darkness	maiart
Moon	miki	Fire	kalla
Stars	milyarn	Smoke	buyu
Thunder	malgar	Food	dad-ja-maraia
Lightning	babbangwin	Day	birait
Rain	moko	Night	kumbardang
Rainbow	walgen	Dawn	waulu
Fog	dulya	Hill	katta
Frost	kurbon	Sandhill	ngobar
Water	gabbi	Leaves of trees, &c.	dilbi
Dew	minyi	Bird's nest	jidamya
Cloud	margabbi	Egg	nurdo
Sky	gud-jait	Pathway	bidi
Planet Venus	jula-goling	Shadow	malliji
Ground	budjor	Summer	birok
Dust	dalba	Winter	maggora
Sand	goyarra	River	bilo
Stone	buyi		
Light (of day)	birait		

Mammals.

Dog	durda	Bat	bambi
Opossum	kumal	Wallaby	banggap
Kangaroo-rat	walyo	Kangaroo	yangor
Native-cat	barrajit	Ringtail Opossum	ngora
Bandicoot	kwogga	Grey squirrel	bellogar
Water-rat	murityа		

Birds.

Crow	wardang	Plover	janjarrak
Plain Turkey	bibilyer	Wh. Cockatoo	manait
Pelican	budtaliang	Mount. Parrot	waukanga
Swan	mele	Musk duck	gatdarra
Wood duck	maranganna	White Owl	binar
Quail	murit	Brown Owl	gurgurda
Eagle-hawk	walja	Bittern	bardanitch
Emu	widji	Grey Thrush	gudilang
Common magpie	gurbat	Blue Crane	waian
Bronze-wing pigeon	wodta	Sparrow Hawk	kurringar
King-fisher	kanyinnak	Fish Hawk	molar

Fishes.

Guard Fish	yellin	Mullet	kalkada
Porpoise	warranang	Frog	wurgail

Reptiles.

Snake	waugal	Carpet-snake	majinda
Lizard	jina-arra	Scorpion	karraima

Invertebrates.

Louse	kolo	Mussel	inbi
Centipede	kambarra	Cray fish	konak
House-fly	murdo	Wild bee	blura
Spider	kara	Leech	ninin
Mosquito	nido		

Trees and Plants.

Native pear	janjin	Honeysuckle	biara
Ti-tree	galyang	Grass tree	balga
Red gum tree	gardan	Bullrushes	batta
White gum tree	wando	Mushroom	yalle

Weapons, &c.

Yamstick	wanna	Hammer	kadgo
Spear, jagged	borail	Stone, knife	tabba
Spear, hunting	gidji	Girdle, opossum fur	nulbarn
Spear, fishing	garbel	Girdle, human hair	niggara
Spear shield	wunda	Nose-peg	mulyet
Spear lever	miro		
Fighting club	dauak		
Boomerang	kaili		

Adjectives.

Alive	wongin	Afraid	mult-chin
Dead	wonnaga	Tired	bidibaba
Large	ngomon	Hot	kallang
Small	nyumap	Cold	nagga
Long	walaiadi	Angry	ngarrang
Short	gorad	Sick	mendaik
Good	gwabba	Stinking	bidjak
Bad	djul	Pregnant	kobbolak
Thirsty	gabbi-gurdak	Tall	urri
Hungry	bailyar	Narrow	nulu
Red	wilgilang	Wet	balyan
White	wilban	Dry	ilar
Black	moan	Soft	ngunyak
Quick	yabbra	Sweet	mulyit
Slow	dabbak	Thin	kotyelarra
Strong	murdoen	Far away	yurar

Verbs.

To die	gwar-do	Ask	wanga-jinnang
Eat	ngannow	Climb	dendang
Sleep	bidjar	Conceal	ballarijau
Stand	yugau	Jump	tandaban
Sit	nginnau	Laugh	goa
Talk	wangau	Scratch	dyirrang
Tell	warrangan	Swim	kauanyang
Walk	yannau	Spit	narrija-gwart
Bring	barrang	Throw	wunnang or gwardo
Take	gangau		
Break	takkan	Whistle	wardail
Strike	buma	Vomit	kandang
Arise	irap	Dance	yallorgannau
See	djinnang	Go	bardo
Hear	katittch	Burn	narrau
Give	yonga	Bite	bakkan
Sing	yeddigarrau	Fly	bardang
Weep	walle	Copulate	muyang
Steal	kwippal		

SOCIOLOGY.

If we take the tribes inhabiting the north-west coast of Western Australia from Roebourne, via Condon and Broome, to Derby, extending inland to the boundary line marked upon the accompanying

map, we find that they are divided into four intermarrying sections or classes, as in the following table. The women are put in the first column, because they represent the cycles, and descent is always reckoned through them.

TABLE A.

Cycle.	Wife	Husband.	Child.
A.	Kaimara	Palchari	Banaka
	Banaka	Booronga	Kaimara
B.	Palchari	Kaimara	Booronga
	Booronga	Banaka	Palchari

The materials from which the above synopsis has been constructed were supplied to me by Mr. J. C. Rose, Fraser River Station; Mr. J. Wilson, Derby; Mr. J. G. Withnell, Hillside, A. E. Clifton, Yeeda Station. Mr. Clifton, in addition, supplied me with 125 words spoken on the Lower Fitroy River[1]. One of my correspondents reports a case which came under his own observation, where a Palchari woman was married to a Palchari husband, and the children were Booronga. This would be a No. 4 marriage.

When Sir John Forrest visited Nicol Bay, near Roebourne in 1878, he found that the natives were divided into four sections, whose names, intermarriage and descent were identical with Table A[2].

If we proceed back south-easterly into the hinterland from Broome and Derby, some distance beyond Joanna Spring, we encounter tribes possessing the same organisation, but having the names of the four divisions somewhat different. These tribes are scattered over the country all the way to Lake McDonald, Petermann Ranges, and onwards into South Australia for a great distance. See No. 2 on the map. The following table shows the mother, father and child, in each of the four sections.

TABLE B.

Cycle.	Wife.	Husband.	Child.
A.	Kamara	Paltara	Pananka
	Pananka	Purula	Kamara
B.	Paltara	Kamara	Purula
	Purula	Pananka	Paltara

Three of the section names in this table are almost identical

1. Queensland Geographical Journal, vol. xix., pp. 71-72.
2. Journ. Anthrop. Inst., vol. ix., pp. 356-357. Aust. Assoc. Adv. Sci., vol. ii., pp. 653-654. Journ. Roy. Soc. N.S.W., vol. xxxii., p. 86.

with those in Table A., whilst one of them, Purula (or Pooroola) is substituted for Booronga (or Pooronga), the first syllables of which are virtually the same, because *p* and *b* are interchangeable in most native words.

Adjoining the last described organisation on part of the south-west is what I have called the Erlistoun community, whose boundaries are approximately indicated by No. 3 on the map. This tract of country includes Malcolm, Erlistoun, Lake Wells, Laverton, and other places in the Mount Margaret gold-field. The intermarriage and descent of the sections are as under.

TABLE C.

Cycle.	Wife.	Husband.	Child.
A.	Boolgooloo	Palchari	Booronga
	Booronga	Kaimara	Boolgooloo
B.	Kaimara	Booronga	Palchari
	Palchari	Boolgooloo	Kaimara

The above table illustrates cycles composed of the same pair of women, as in Table D., *infra*, but the husbands are "alternative." That is, a man of any given section at Erlistoun would have a mother of the same section name, as if he were a native of, say, Milly Milly on the Murchison; but his father would have the name of the other section in the cycle; in other words, the cycles consist of the same pairs of sections.

In portions of the above area, the name Boolgooloo is interchangeable with Banaka, as in some of the tribes represented in Table D., *infra*. Again, some of my correspondents observed that Turraroo was sometimes substituted for Palchari. Milunga and Ibalgu were also mentioned, but whether as names of cycles or sections, I was unable to determine. Perhaps Turraru, Milunga, Ibalgu, and Boolgooloo are the names of the sections till puberty is reached, similarly to the names of the sections in the Chingalee and other tribes reported by me[1]. My correspondents in dealing with the Erlistoun community were Mr. K. Young and Mr. D. Connors.

The space numbered 4 on the map comprises the region drained by the Fortescue and Ashburton, and the upper portions of the Gascoyne, Murchison, Sanford and other rivers. The organisation of the tribes therein is represented in the following table. My correspondents were Mr. D. Stewart, Balmoral; Mr. W. G. Learmonth, Nanutura; Mr. Edward Smith, Milly Milly; Mr. H. J. T. Hodgson, Braeside, and others.

1. American Anthropologist, vol. x., N.S., pp. 282-283

TABLE D.

Cycle.	Wife.	Husband.	Child.
A.	Booronga	Palchari	Banaka
	Banaka	Kaimara	Booronga
B.	Palchari	Booronga	Kaimara
	Kaimara	Banaka	Palchari

On the Upper Murchison and surrounding country, Boogaloo (or Boolgooloo), is substituted for Banaka, as reported by me in 1900[1]. It may be stated here that Mr. Learmonth reported that he knew a case where a Booroonga man had a Kaimara wife, and the family were Palchari, which is my "alternative," or No. 2 spouse.

In a narrow strip of country along the coast, from about Dongarra to Exmouth Gulf, marriages were arranged by the *tu-ar* system, described by me in 1900[2], with descent counted through the mother's lineage. The *tu-ar* region is practically overlapped by the four-section organisation illustrated in Table D.

The tables A. to D., inclusive, represent the normal marriages, which I have elsewhere called "No. 1," where a man or a woman obtains a spouse from the other section in the opposite or normal cycle, it is what I have called an alternative or "No. 2" marriage, an example of which is reported among the tribes represented in Table D. Again, the case reported under Table A., where a man or woman takes a mate from his or her own section, has been called by me a "No. 4" marriage. In the present treatise there is not an example of a person taking a spouse from the other section of his or her own cycle, called a "No. 3" marriage, but I am told by correspondents that the natives say they are lawful in certain cases.

The foregoing tables A. to D. not only prove the same organisation, but the names of the divisions are substantially the same, and in all of them descent is counted through the women. Inspection of the map will show that this organisation obtains over more than half the State of Western Australia.

The line from A. to B. on the map closely approximates the western boundary of the tribes who practise *splitting the urethra and circumcision*, neither of these customs being found between that line and the sea coast. It should be stated, however, that from the point A., along the coast to about Roebourne, the rites

1. Proc. Amer. Philos. Soc., vol. xxxix, p. 124.
2. Queensland Geographical Journal, vol. xix., p. 51.
Proc. Amer. Philos. Soc., vol. xxxix., pp. 560-562, with map.

referred to are not now insisted upon. As far as my correspondents can yet discover, these rites are in vogue over all the rest of Western Australia.

Within the tract numbered 5 on the map, I have not yet been able to obtain definite particulars of the social organisation of the people; some of my correspondents state that descent is through the mothers, whilst others affirm that it is counted through the fathers; but I intend, during the next year or two, to visit Western Australia and make personal inquiries.

In 1831, Dr. Scott Nind reported that the natives of Albany were divided into two sections, with female descent[1]. This line of descent was confirmed by Sir George Grey in 1841, regarding the tribes about Perth, but he mentioned more than two sections in their organisation[2]. In 1904, on the authority of Mr. Thomas Muir, of Deeside, I reported two sections with descent regulated by the fathers[3]. In 1907, I stated that " from the information then to hand it was impossible to arrive at any definite conclusion regarding the descent[4]." From information received since then, I am now of opinion that the people are divided into four sections, similar in structure to their neighbours on the north, but with different section names. I understand, however, that Mrs. D. M. Bates is preparing a general account of the aborigines of Western Australia, and therefore, I shall wait the publication of her work.

In the south-east corner of Western Australia, from Eucla to Eyre's Sand Patch, or perhaps Israelite Bay, or Esperance Bay (see No. 6 on the map), the tribes have a similar organisation to those at Port Lincoln and intervening country[5], with only two principal sections or cycles, with maternal descent. This information was obtained from the Manager of Yalata Station, about 200 miles east of Eucla.

In the north-east corner of Western Australia, marked 7 on the map, the social organisation comprises eight sect ons, the names of which were first reported by me nine years ago[6]. This eight section system obtains on Sturt Creek, the numerous tributary streams of the Ord River, the Upper Fitzroy, Durack River, etc. I have not

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1. Journ. Roy. Geo. Soc., London, vol. iii., pp. 37-44.
2. Two Exped s. N.W. and W. Australia, vol ii., pp. 225 and 228.
3. Queensland Geographical Journal, vol. xix., p. 51.
4. *Op. cit.*, vol. xxii., p. 80.
5. Proc. Amer. Philos, Soc., vol. xxxix., pp.79-82. with map. Dr. A. W. Howitt copied extensively from that map, without the slightest acknowledgment.
6. American Anthropologist, vol. ii., N.S., p. 186.

yet succeeded in determining whether the blacks on the coast, from Calder River northwards to Drysdale River, have four or eight sections ; I have accordingly marked that area on my map as doubtful ?

Among my correspondents were Mr. J. Wilson, Hall's Creek ; Mr. Stretch, Denison Downs, Sturt Creek ; Mr. J. C. Booty, Koojoobrin, and others. Mr. Wilson, likewise, sent me a vocabulary of 120 words of the language spoken around Hall's Creek[1].

Following is the synopsis published by me in 1900[2].

TABLE E.

Cycle.	Wife.	Husband.	Child.
A.	Changura	Chungala	Chambin
	Chanima	Chulima	Chagara
	Chambin	Chungardin	Chanima
	Chagara	Chabaldyi	Changura
B.	Chungala	Changura	Chabaldyi
	Chulima	Chanima	Chungardin
	Chungardin	Chambin	Chungala
	Chabaldyi	Chagara	Chulima

Marriages of the Nos. 1, 2, 3 and 4 types have been explained elsewhere, and need not be repeated[3].

Where the two types of organisation meet on the Fitzroy River Mr. Wilson ascertained that the equivalence of the eight sections at Hall's Creek to the four sections at Derby (Table A.), is as follows : Changura and Chanima are the equivalent of Kaimara ; Chagara and Chambin are equal to Banaka ; Chungala and Chulima equal Palchari ; and Chungardin and Chabaldyi correspond to Booronga.

These natives are ignorant of the natural facts of procreation, and their beliefs regarding conception are similar to those of other tribes described by me. The totem of a child is determined by the locality of its birth instead of by its parentage[4], but the child's section name depends absolutely upon the mother only.

Folklore.

Some legendary tales current among the natives occupying the country between Albany and Busseltown, related to me by an old resident of the district, who had personally gathered them from the

1. Journ. Roy. Soc. N.S. Wales, vol. xxxv., pp. 220-222.
2. American Anthropologist, vol. ii., N.S., pp. 185-187.
3. Proc. Amer. Philos. Soc., vol. xliv. pp. 32-35.
4. Queensland Geographical Journal, vol. xxii., pp. 75-76 and 79. Journ. Roy. Soc. N.S. Wales, vol. xl., pp. 107-111.

blacks, will be useful for comparison with tales from other parts of Australia.

How Fresh Water was Obtained.—In ancient times all the coast tribes drank salt water. The eagle-hawk, *wallitch*, never drank with the rest, but always went back into the hinterland. One day the fish-hawk, *molar*, watched him going to a forked tree, from which he removed a piece of bark and had a drink. After the eagle-hawk went away back to his camp, the fish-hawk approached the tree for the purpose of making investigations. As soon as *molar* lifted up the piece of bark, the water flowed out in torrents, and filled all the hollow places, making creeks, rivers and lakes as they now appear.

The White-topped Rocks, near Cape Chatham.—In those olden days there was a large plain extending from the main land out to the White-topped Rocks, about nine miles out from Cape Chatham. On one occasion two women went far out on the plain digging roots. One of the women was heavy with child, and the other woman had a dog with her. After a while they looked up and saw the sea rushing towards them over the great plain. They both started running towards the high land about Cape Chatham, but the sea soon overtook them, and was up to their knees. The woman who had the dog picked it up out of the water and carried it on her shoulders. The woman who was far advanced in pregnancy could not make much headway, and the other one was heavily handicapped with the weight of the dog. The sea getting deeper and deeper soon overwhelmed them both, and they were transformed into the white-topped rocks, where the stout woman, and the woman carrying the dog can still be seen.

The Making of Mt. Johnston and other Hills.—On another occasion there was a party of natives cooking a big heap of roots, which they had gathered. A dispute arose about the partition of the food, and one of the men who was a *mulgar*, or wizard, drew his foot and kicked the heap of roots in all directions. Some of them became Mt. Johnston, whilst some more were turned into other rocky hills in that locality, upon which large root-shaped rocks can still be distinguished.

The Origin of Fire.—In olden times the bandicoot had the monopoly of the fire. It was shut up in a nut, which he always carried about with him, secreted in his anus. The other people noticed that his meat was always tender and different from theirs, and they asked him the reason of it. He told them he laid it on a rock and let it cook by the heat of the mid-day sun. They also observed that the barbs were neatly fastened on to his spears with gum, and that all his weapons were better finished than those of other people.

Repeated inquiries as to how he managed all these things elicited nothing definite, and consequently the pigeon, *watta*, and the sparrow-hawk, *kurringar*, were appointed to watch him when out hunting. About the middle of the day they saw smoke rising from where he was camping, and as they could not make out what it was, they stole upon him unawares. As soon as the bandicoot saw them he commenced putting the fire into the usual receptacle; but the sparrow-hawk, who was always very quick in his movements, made a sudden rush and secured some of it, with which he set fire to the surrounding bush. Every tree, from the hardest to the softest, got a share of the fire, from which the blacks have obtained it ever since.

Why Lakes are Salt.—The Kimberley natives believe that a supernatural monster, in serpent form, made all the rivers as he travelled in from the sea. The big waterholes are places where he rested at night. Once he camped for a long time at the lake into which Sturt Creek empties, and it is owing to his wine that the water there is saline. The saltness of other lakes in that part of the country is ascribed to the same cause. This creature is known as Ranbul in some districts, and as Wonnaira in others.

Some Customs and Superstitions[1].

The following customs and beliefs were current among the blacks in the vicinity of Albany, Bridgetown, Mount Barker, and adjacent country. The information was obtained for me by Mr. Thos. Muir, J.P., of Deeside Station.

An old blackfellow, who lived on Mr. Muir's estate years ago, used to sit down and relate stories about the stellar constellations. He would point out certain conspicuous stars and stellar groups, and tell how they fought, avenging the death of friends and warring with enemies, when they were men living on the earth.

It was a custom for certain men to let their hair grow for two or three years. Then a boy about fifteen years of age, wearing a *mulyet*, or nose-peg, made from a small bone out of a kangaroo's leg, was sent as a messenger to different families or triblets throughout a large district, to invite them to meet at a specified place, where there was a good food supply. He might be about a year away on this business, and all the people he visited treated him kindly. He was accompanied by a middle-aged man to the first camp of people, and they in turn found another convoy to take the lad to the next mob, and

1. For some other beliefs of the aborigines in Western Australia, see Queensland Geographical Journal. vol. xix., pp. 61-63.

so on; the men who acted as convoys returning to their own tribes respectively.

When the time of meeting came round, the various mobs travelled to the appointed locality from all parts of the district, and a big corroboree was held. A lock was cut by each of a number of persons from the head of the men with the long hair, and names were exchanged. With the hair they manufactured brow bands and waist girdles, the latter being several yards in length. Each of the contingents who assembled at the general meeting place would have some men with long hair, which was cut in the same manner and exchanged.

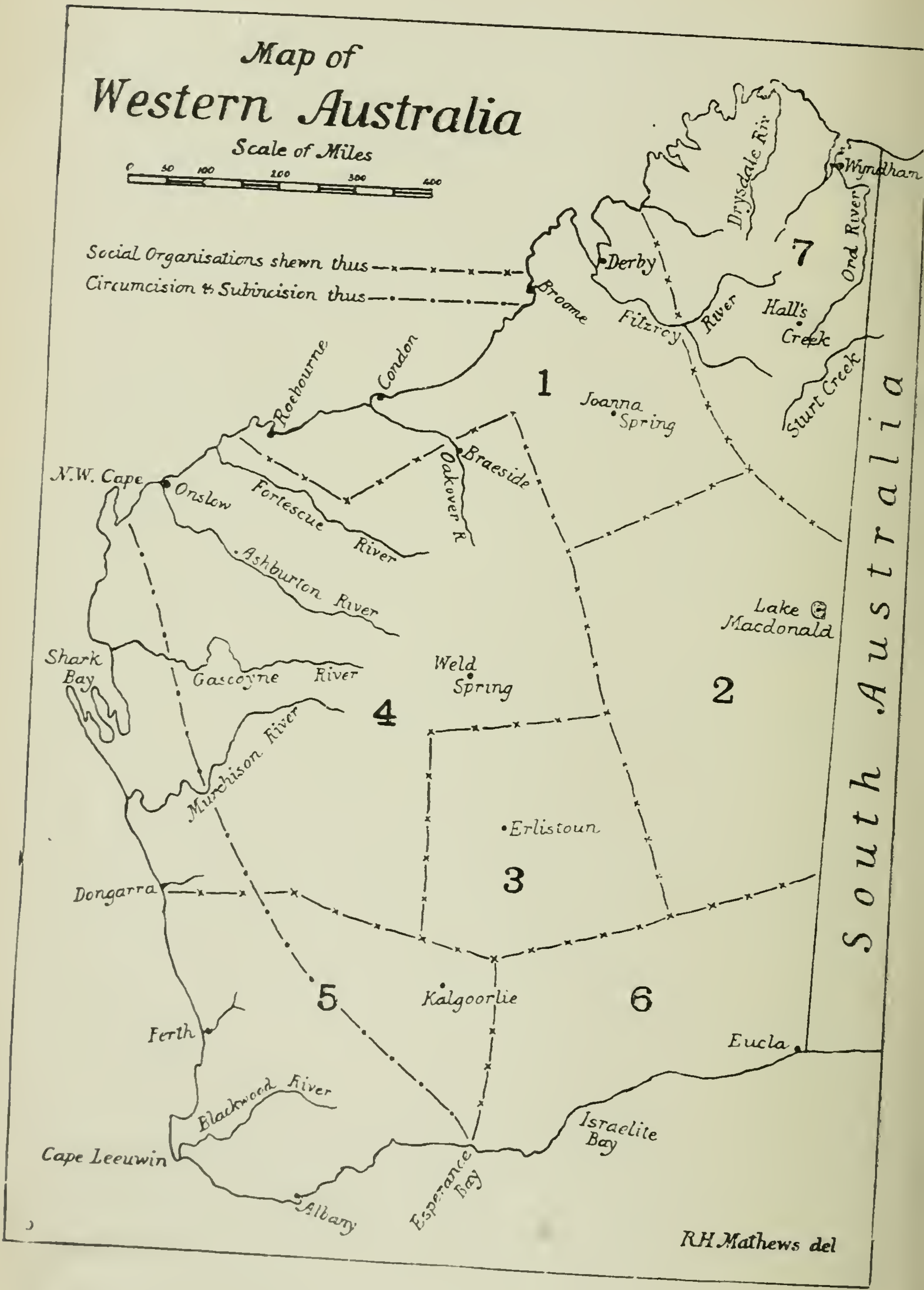
When a man died, his eldest brother took his widow; if he did not want her, the next eldest brother had the right.

Mr. Muir, who has known the country between Perth and Israelite Bay since 1844, states that he never knew or heard of canoes being used by the natives. The rivers are small, and the people could generally find a tree which had fallen across the stream, or which had been washed down by floods, which served the purpose of a bridge.

A medicine man or sorcerer was called *mulgar*, and was supposed to be able to draw pieces of spears and other things out of a man's body, and so cure him of any real or imaginary illness. He could cut open the body of an enemy, and take out his fat, and close up the wound without leaving so much as a scratch upon the skin. A *mulgar* could go up to the moon, make thunder, cause storms of rain or wind, and do many other wonderful things.

The natives believed that it was evil spirits which struck trees and split them during a thunderstorm. When they saw a small tree which had been struck by lightning, they would laugh and say to each other that the spirit who had done that was only a slender fellow, because a powerful spirit would have practised his skill on a larger tree. If an evil spirit, or *wein*, came to a man in the bush, and he attempted to strike at it, he would only hit himself on whatever part of the body he tried to hit the spirit upon. His only means of escape from the attack of such a spirit was to run and get on top of the nearest white-ant hill; then he was just as safe as Tom O'Shanter, when he had passed the keystone of the bridge.

The Fly-catcher, a little fan-tail bird, was formerly a wicked man with a bushy beard, always going about doing mischief and carrying tales. When the blacks see one of these birds, they kill it if they can. It still has whiskers as in times of yore, which are represented by a little bunch of greyish feathers on each jaw.


Map of
Western Australia
Scale of Miles
0 50 100 200 300 400
Social Organisations shewn thus
Circumcision & Subincision thus
Drysdale Riv
Wyndham
Ord River
7
Derby
Broome
Fitzroy River
Hall's Creek
Sturt Creek
Condon
Roebourne
1
Joanna Spring
Braeside
Oakover R
N.W. Cape
Onslow
Fortescue River
Ashburton River
Lake Macdonald
Shark Bay
Gascoyne River
Weld Spring
4
2
Murchison River
South Australia
Erlistoun
3
Dongarra
5
Kalgoorlie
6
Perth
Eucla
Blackwood River
Israelite Bay
Cape Leeuwin
Esperance Bay
Albany
R.H. Mathews del

PROCEEDINGS

OF THE

Royal Geographical Society of Australasia,

QUEENSLAND.

Annual General Meeting and Twenty-fifth Anniversary Celebration,

AUGUST 27TH, 1910.

This took the form of a river trip on the Queensland Government Steamer, "Lucinda," kindly placed at the disposal of the Society by the Chief Secretary, Hon. William Kidston. The occasion was favoured in every way, a distinguished company headed by His Excellency the Governor, Sir Wm. MacGregor, Patron of the Society, Lady MacGregor, and Miss MacGregor, and gloriously fine weather lending to the function the eclat, which so interesting a phase in the history of the Society demanded. There was a large number of the members and their friends present, including many ladies. These were received on board the steamer by Sir Arthur Morgan (the President of the Society), Lady Morgan, Dr. J. P. Thomson (the Hon. Secretary and Treasurer), and members of the Council, including, Hon. F. T. Brentnall, M.L.C., Hon. W. F. Taylor, M.D., M.L.C., Mr. James Stodart, M.L.A., Mr. Geo. Fox, M.L.A., Mr. A. A. Spowers, Mr. A. C. Raff, C.E., Mr. Alexr. Corrie, Mr. E. J. T. Barton, Mr. E. E. Edwards, B.A. His Excellency the Governor was present as representative of the University of Glasgow, the University of Edinburgh, and the Royal Geographical Society of England.

A large number of congratulatory messages were read from all parts of the globe, amongst which the following were included :—

C.K.,
Česká Universita,
Karlo-Ferdinandova,
V Praze.

Prague, July 10th, 1910.

Sir,

The Rector and Senat of the Imperial Royal Bohemian Carolo-Ferdinandean University of Prague having only too late received your kind invitation to the festivities by which the Royal Geographical Society of Australasia, Queensland, celebrated at the end of June, the 25th anniversary of its existence, beg to present their warmest thanks for the honour of this invitation, and to express their congratulation to the rich harvest of scientific work of which the R. Geogr. Society has every right to be proud. At the same time we beg you to forward our congratulations also to the Founder of the R. Geogr. Society, the Honorary Secretary of the same, Dr. J. P. Thomson.

KRAL,

Rector.

CABLEGRAM.

QN 8 15 Edinburgh 4.40 p.m. 29 June 1910.

President,
Royal Geographical Society,
Brisbane, Australia.

Hearty congratulations from Edinburgh University on Society's twenty-fifth anniversary.

8.45 a.m.j

UNIVERSITY OF LONDON.

South Kensington, S.W.
1st June, 1910.

Dear Sir,

I am directed by the Senate of the University of London to ask you to convey their thanks to the Royal Geographical Society of Australasia for the invitation to attend the Twenty-fifth Anniversary of the Foundation of the Society. The Senate regret that they have been unable to send a Delegate to the celebration ; but beg the Society to accept their cordial good wishes for its continued prosperity.

I am, dear Sir,
Yours faithfully,
HENRY A. MIERS,
Principal.

FROM THE VICE-CHANCELLOR OF THE VICTORIA UNIVERSITY OF MANCHESTER.

May 5th, 1910.

Sir,

I beg to acknowledge the receipt of your letter of the 1st March. Our University desires to offer its congratulations on the occasion of the Twenty-fifth Anniversary of the foundation of the Royal Geographical Society of Australasia. We regret, however, that distance prevents any member of our Senate from being present at the Celebrations.

With hearty good wishes for the future of the Society.

Believe me,
Yours faithfully,
ALFRED HOPKINSON,
Vice-Chancellor.

The Hon. Secretary,
Royal Geographical Society of Australasia,
Brisbane.

Principal's Office.

Queen's University,
Kingston, Ont.,
13th April, 1910.

J. P. Thomson, Esq., LL.D.

Dear Dr. Thomson,

This morning I received your circular letter of March 1st, intimating the approaching celebration of the twenty-fifth anniversary of the foundation of the Royal Geographical Society of Australasia. It would be a great pleasure

to me if I could accept your invitation to be present at the celebration, but as that is impossible I must content myself with sending you in the name of Queen's University, as well as in my own name, our congratulations on the successful work of the Society, and our best wishes for the its future welfare.

Believe me,

Yours very faithfully,

DANIEL M. GORDON.

FROM SIR NATHAN BODINGTON, VICE-CHANCELLOR, THE UNIVERSITY, LEEDS

19th May, 1910.

Dear Sir,

I beg to thank you for your communication informing me of the forthcoming Celebration of the Twenty-fifth Anniversary of the Foundation of the Royal Geographical Society of Australasia.

I regret that it is impossible for any member of the Senate to convey personally to you our congratulations on this auspicious occasion, but you may be none the less assured that we learn with satisfaction of the prosperity of your Association, and that you have our fullest good wishes for the future.

Believe me,

Faithfully yours,

NATHAN BODINGTON,

Chairman of the Senate of the University of Leeds.

Sir Arthur Morgan, Kt., F.R.G.S.

SOCIÉTÉ DE GÉOGRAPHIE, PARIS.

Paris, lé 15th Avril, 1910.

Monsieur le Président,

Nous sommes en possession de votre lettre du ler Mars dernier par laquelle vous nous informez que la Royal Geographical Society of Australasia, Queensland, célèbrera la 25e anniversaire de sa fondation à la fin da Juin prochain.

La Société de Géographie tient à s'associer à cette manifestation nous charge de vous adresser ses chaleureuses félicitations ainsi que ses souhaits de prospérité.

Heureux d'être en cette circonstance les interprètes de nos collègues, nous vous prions d'agréer, Monsieur le Président l'assurance de notre considération la plus distinguée.

Le Secrétaire général,

HULOT.

Le Président

de la Commission centrale,

Emmanuel de Margerie.

A Monsieur Arthur Morgan,

Président de la Royal Geographical Society of Australasia.

ROYAL GEOGRAPHICAL SOCIETY.

1, Saville Row,
Burlington Gardens,
London, W.
May 11th, 1910.

Dr. J. P. Thomson,
Royal Geographical Society of Australasia,
Brisbane, Queensland.

Dear Dr. Thomson,

Your circular letter of March 1st, advising us of the approaching Celebration of the 25th Anniversary of the Foundation of your Society, was placed before the Council on Monday. I am desired to beg you to convey to your Society the warmest congratulations of the Council on its having attained its semi-Jubilee.

It has done very good work in the past, and the Council hope and believe that it will continue to do equally good work in the future. The Council regret that none of its members will be able to attend personally as Delegates of the Society, but I am writing to our distinguished Fellow and Medallist, His Excellency Sir William MacGregor, asking him if he would be good enough to act as representative of our Society on this occasion.

Believe me to be, dear Dr. Thomson,
Yours very truly,
J. S. KELTIE,
Secretary, R.G.S.

MANCHESTER GEOGRAPHICAL SOCIETY.

16, St. Mary's Parsonage, Manchester,
June, 13th, 1910.

The Council of the
Royal Geographical Society of Australasia,
Queensland.

Gentlemen,

We are pleased to acknowledge with many thanks your communication in regard to the twenty-fifth anniversary of the Foundation of your Society.

We are requested by our Council to offer to you our sincere and hearty congratulations on this important event in the history of your Society ; a similar event was celebrated in our case last autumn.

We trust that the celebration of the Anniversary will be as successful as the twenty-five years work of the Society has been. In congratulating your Society we must ask your Hon. Secretary and Treasurer, Dr. J. P. Thomson, to accept a large share of such congratulations, as we seem always to think of your Society in conjunction with him, he having been so intimately connected with it from the commencement.

Trusting that you may continue to prosper, we, on behalf of the Council beg to subscribe ourselves.

Yours faithfully,
J. HOWARD REED, Honorary Secretary,
HARRY SOWERBUTTS, Secretary.

LINNEAN SOCIETY OF NEW SOUTH WALES, 23 ITHACA ROAD, ELIZABETH BAY.

Sydney, August 19th, 1910.

The Hon. Secretary,

Royal Geographical Society of Australasia, Queensland.

Dear Sir,

I have pleasure in acknowledging receipt of the invitation from the President and Council of your Society, to the Officers and Council of this Society, to attend the special gathering arranged for 27th instant, in celebration of the semi-Jubilee of your Society. Under more favourable circumstances, as regards distance, it would be my pleasing duty to signify cordial acceptance of the kind invitation. But as none of us are in the position of being able to make a special visit to Brisbane, next week, I can only express regret to you, that this should be so ; and, at the same time, to convey to you the Council's best wishes, that your special gathering may be both very interesting and enjoyable.

Yours faithfully,

J. J. FLETCHER,

Secretary.

ROYAL SOCIETY OF TASMANIA.

Hobart, August 23rd, 1910.

The Hon. Secretary,
Royal Geographical Society,
Brisbane,
Queensland.

Dear Sir,

I am directed by the Chairman of the Council to state that the Officers and Council of the Royal Society of Tasmania much regret they are unable to accept the invitation of the Royal Geographical Society of Australasia, Queensland, to celebrate the semi-Jubilee of the formation of the Society, on Saturday, 27th August inst.

The Royal Society of Tasmania desires to offer their congratulations to the Royal Geographical Society of Australasia.

I am, dear sir,

Yours faithfully,

ROBERT HALL,

Secretary to the Council.

ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA (SOUTH AUSTRALIAN BRANCH),

Adelaide, August 20th, 1910.

Dear Sirs,

I beg to express the sincere congratulations of my Council on the approximate arrival of the 25th Anniversary of the formation of your Society in Queensland, and to thank you for the invitation to my President and Council to be

present at your Celebration on the 27th prox., an invitation which they much regret their inability to accept.

I remain, dear Sirs,
Faithfully yours,
THOMAS S. REED,
Secretary.

To the President and Council of
The Royal Geographical Society,
Queensland.

THE UNIVERSITY OF MELBOURNE,
26th August, 1910.

Dear Sir,

In the name of the Chancellor and Senate of the University of Melbourne, I beg to thank your President and Council for their kind invitation for the 27th instant in celebration of the Society's semi-Jubilee. It is regretted that no member of the Council can be present on that occasion, but you have our good wishes for the continued success of your Society.

Yours truly,
H. BAINBRIDGE,
Registrar.

The Hon. Secretary,
Royal Geographical Society,
William Street, Brisbane.

HIS EXCELLENCY'S ADDRESS.

His Excellency the Governor said :—" I have been asked to represent on this important occasion certain learned bodies in the United Kingdom. First of all, I was invited by Sir Donald Macalister, the principal of the University of Glasgow, to represent that institution. Then I was asked by Sir William Turner, principal of the Edinburgh University, and also by the President and Secretary of the Royal Geographical Society of England, to represent those institutions at this gathering. Now, I do not understand that I was asked to represent those three great learned bodies simply to congratulate this Society on having attained its 25th anniversary, but rather to compliment it on its splendid achievements. I take it that my mission, if I may venture to so describe it, is very much more to express appreciation of the work of the Society, than to congratulate it on its age. I myself have been connected with the Society in a measure for over a score of years, so that I am able to form a fairly good opinion as to what has been accomplished. In conversations I have had with the former President of the parent Society (Sir Clements Markham), and with the secretary (Dr. Scott Keltie) they both have expressed very high appreciations of the work done by the Queensland society, the principal credit for which they certainly were inclined to ascribe to the indefatigable Secretary, Dr. Thomson, who not only had originated the society, but had lent the motive power to it ever since. Now, ladies and gentlemen, it appears to me that since the days when I began to learn anything at all, methods of study, particularly in regard to the acquirement of scientific knowledge, have undergone great changes. When I first commenced to study Geography, it consisted principally in learning the courses of rivers and the positions and heights of

mountains, with some political boundaries thrown in, and such things as that; but it appears to me that the whole subject has taken on now a totally different aspect, and the Geography of the present day, if not absolutely the greatest subject we have, is certainly one of them.

"It seems to me that this has come about to a large extent from a recognition of what I might call the universality of the universe. It is now recognised that a complete knowledge of the earth is simply impossible without a knowledge which extends into the remotest regions that we are cognisant of, and that knowledge is only attainable by the aid of the telescope and the spectroscope. In the last number of the Revue des Deux Mondes which I have received, is an article by M. Normand, one of the most celebrated of our modern investigators, and in the article (which has reference to a large amount of original work by himself) it is most clearly laid down that this little earth of ours is simply part of the great universe that we have to study before we can become acquainted, to any extent, with the little globe on which we live. There are still many problems to solve concerning the earth itself, all connected with Geography, which invite the closest study. For example, it is by no means clear why temperature increases with depth in some parts of the world more than in others. Nor has it ever been satisfactorily explained whether the base of a great mountain is hollow, or whether it is not simply a bridge over something below. M. Normand has shown the strange manner in which things grow as they proceed outwards from the earth. In round numbers the diameter of the globe is 8,000 miles. Then comes Jupiter with over 80,000 miles; and after that the sun, something over 800,000 miles. By means of an ingenious method of computation, M. Normand has been able to give the diameter of the star Aldebaran as something over 8,000,000 miles. For a long time we have been aware that the sun is, in volume, about 1,300,000 times greater than the earth; but, in the same proportion it would appear from M. Normand's calculations that this star Aldebaran is nearly one thousand three hundred million times the size of the earth. These, and a great many other questions of a similar nature are before us now, and invite our study in connection with Geography or description of this little globe of ours. Among these are the questions of the distance of these stars, their composition and temperature. M. Normand has established clearly that although the temperature of the sun is only about 5,300 degrees centigrade, the star Antares has a temperature of 40,000 degrees centigrade, and that there are other stars the temperature of which is so great that it reduces all the elements into one—hydrogen. I remember it being said that Professor Graham, many years ago, told the students of Anderson's University that there was probably only one element, namely Hydrogen. It is by pursuing study in such directions as these that we can learn something of the universality of the universe."

The Report of the Council and financial statement were presented and adopted. The officers and Council for the session 1910-1911 were elected as follows:—Patron, His Excellency Sir Wm. MacGregor, G.C.M.G., C.B., M.D., LL.D., D.Sc., etc.; President, Hon. Sir Arthur Morgan, Kt., F.R.G.S., etc.; Vice-Presidents, Mr. George Phillips, C.E., Hon. F. T. Brentnall, M.L.C.; Hon. Sec. and Treasurer, J. P. Thomson, LL.D., Hon. F.R.S.G.S. Other members of the Council:—Messrs. George Fox, M.L.A., James Stodart, M.L.A., A. A. Spowers, E. J. T. Barton, Alexr. Corrie, A. C. Raff, C.E., E. E. Edwards, B.A., Hon. W. F. Taylor, M.D., M.L.C.

His Excellency the Governor, on behalf of the Council, then presented to Sir Arthur Morgan, the handsome Thomson Foundation Gold Medal of the Society, which had been awarded to Sir Arthur Morgan in recognition of the valuable services which he had rendered to the Society during many years. As Sir Wm. MacGregor put it, Sir Arthur entered as a private, served on the staff, and now had risen to Commander-in-chief. He was sure the medal could not have been more worthily bestowed.

Sir Arthur Morgan, in acknowledging the honour, said he had done his best to make the society a progressive institution, and he hoped its future work would entitle it to rank among other societies in countries similarly circumstanced to their own.

Finally, His Excellency the Governor presented the society's diploma of fellowship to Mr. George Phillips, C.E., Mr. T. S. Sword, Mr. A. A. Spowers, Mr. A. S. Kennedy, Sir Samuel Griffith (Honorary), and Mr. R. H. Mathews. The first named was represented by Mrs. Phillips, and the two last named were not present to receive the honour personally. A hearty vote of thanks was extended to the Governor for his presence.

The trip down the river was resumed as far as Pinkenba, afternoon tea being served meanwhile. The steamer was then put about, and the Queen's wharf was reached about 5.30 p.m.

ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

REPORT OF COUNCIL, 25TH SESSION, 1909–1910.

In submitting to the Fellows and Members, the Twenty-fifth Annual Report on the operations of the Society during the financial year, ending on the 30th June, 1910, the Council, while feeling gratified at the substantial addition to the Roll, deeply regrets the loss sustained by the passing away of two old and greatly valued subscribers, Messrs. A. E. Aldridge, Maryborough, and W. B. Taylor, Toowoomba. As noted in some of the preceding reports, there is an increasing demand for the Journal, containing the "Proceedings of the Society," the earlier numbers, issued under the title of "Proceedings and Transactions" being now out of print and unprocurable for distribution to kindred institutions.

The active work of the Society has been kept up with undiminished vigour during the preceding year, there being usually large attendances at the monthly and special general meetings, while the papers read, and the addresses delivered, were of much general interest and scientific value, most of the subjects being profusely illustrated by lantern slide pictures. At the May meeting an interesting address was given by the Hon. F. T. Brentnall, on a "Trip to Western Canada," and this was followed at the subsequent meeting in June by Mr. E. E. Edwards' entertaining discourse on "Syria and Palestine," both of which embodied the results of personal observations. The ordinary work of the session was varied considerably, and rendered unusually interesting by the expedition sent out by the Council to the Gulf of Carpentaria to identify and fix the position of certain trees marked by the ill-fated explorers, Burke and Wills, at their Camp, No. 119, on the right bank of the Bynoe River, south-west from Normanton. And it is especially gratifying to note that this, the first exploratory enterprise of the kind into which the Society has entered, was eminiently successful.

Notwithstanding the heavy working expenses of the session, including £39 7s. 6d. for the Gulf Expedition, and the fact that these are annually increasing as the operations of the Society develop, it is encouraging to be able to remark that the finances are in a satisfactory condition. Besides the Standing Medal Fund of £250 vested in Royal Bank Preference Shares, and the accumulated interest of £18 15s. on same for the purchase of the next Gold Medal, which the Council has awarded to the President, for valuable services

rendered, the financial year closed with a credit balance of £61 17s. 10d., the details of which are given in the annexed balance sheet.

The Library of the Society continues to grow year by year to such an extent as to tax the available space at the disposal of the Council for adequately shelving the many valuable works that come to hand from time to time from Exchange Societies and other sources. In bringing to a close the first twenty-five years of the Society's activities, brief allusion may be made to the work accomplished since the last historical review was published, on the occasion of the 21st Anniversary Celebration. But, first of all, let it be mentioned that the last quarter of a century has witnessed some of the most remarkable exploits in the field of exploration and discovery known to history. In Asia alone, the remarkable discoveries brought to light during the last few years, have drawn the attention of the whole intellectual world to that vast desert region within the borders of Indo-China, where traces of former civilisation have been buried for ages beneath the shifting sand dunes of that inhospitable country. Stupendous chains of mountain ranges, with lofty peaks and storm-swept passes have been discovered, and their leading features now fill up the blank spaces that have for so long been a blemish upon the surface of the maps, and a standing reproach to pioneering enterprise. Large lakes have been shown to exist where formerly there was nothing known but desert waste, the sources of mighty rivers have been located, and many important tributory streams brought to light in that vast Trans-Himalaya region.

The rivalry associated with the struggles to reach the poles of the earth has brought about some remarkable developments in the methods of polar travel and exploration Baloons, airships and motor sledges are now requisitioned into the services of those brave and hardy men, who are attempting to wrest from stern nature the secrets that have for untold ages been hidden beneath the external snow and ice caps of both hemispheres. In the south, no less than in the north, our knowledge has been vastly increased during recent years of pioneering effort. Less than 100 geographical miles have yet to be traversed to reach the most remote point of the Antarctic Continent, while the North Pole is said to have been captured between Commander Peary and Dr. Cook, and presented by the former to the President of the United States of America, with befitting compliments. Let it be hoped that Captain Scott will be equally fortunate as the trusted leader of the British National Expedition, now on its way to the South Polar regions, and that he may return to civilisation with the secrets of the South Pole locked up in the recesses of his heart to be unfolded to the intellectual world at large, as the happy results

of all-British enterprise in the glorious field of exploration and discovery. But splendid results have already been achieved by Sir Ernest Shackleton's memorable dash into the very heart of the great Southern Continent, where the Magnetic Pole was reached by Professor David, who accompanied the expedition, and climbed to the summit of Mt. Erebus. And in the great national work of far southern exploration this Society can lay claim to a modest share, it being chiefly owing to its representations and active co-operation that the State of Queensland contributed £1,000 towards the expenses of the first expedition sent out under the leadership of Captain Scott some years ago, and the Australian and New Zealand Governments agreed to give free entry to the vessels associated with the enterprise. In the South Polar area, it may confidently be anticipated that many important discoveries await the organised effort of scientific investigation, that our limited knowledge of its physical conditions, natural history, magnetic elements, and atmospheric movements will be vastly increased by the international expeditions now being sent out there. But it is in Africa where some of the great exploratory achievements of the last twenty-five years have been accomplished. The vast equatorial regions of that interesting country have been traversed by Stanley, Emin Pasha, Schweinfurth and their contemporaries in the field of exploration and discovery. The immense lakes and rivers have been delineated and mapped out, the mighty mountain ranges of Ruwenzori have been conquered by the Duke of the Abrutzze and their position, rightly located for the first time in human history, while other culminating points of the continent, including Kenia and Kilima-njaro have been examined in detail. The great Congo basin, and the enormous valley of the Nile have been investigated, and their natural and almost inexhaustible resources developed to a remarkable extent, including the economic utilisation of the fertilising waters of the latter, and the irrigation of extensive areas on the banks of that mighty stream. Nor are these wonderful changes confined to the northern and central divisions of the Continent, for equally important developments have taken place in the south, where racial sentiments at one time led to serious national conflicts endangering the peace of Europe, and interfering with the political and industrial progress of the Empire. But happily, those disturbed times in the history of that great and wealthy country have long passed away, and are now succeeded by complete political union of states and people. Industrial peace has once more been established upon a solid and lasting foundation, the unlimited mineral resources of United South Africa are being extensively developed; a grand trunk line has been laid down from Cape Town to Cairo, and the heart

of the Continent has been opened up to settlement and colonisation, in which British capital and enterprise have been freely utilised to the advancement of civilisation, and the moral and material welfare of the race at large.

In North, Central, and South America, too, the geographical spirit of the age has left its indelible impress upon the public life and institutions of that greatly diversified and progressive country. The Alaskan and Labrador territories have been explored, and many important physical features discovered. Mt. McKinley and Mt. St. Elias, in the first named territory, have been ascended, and our knowledge of their physiography greatly increased. Rich gold bearing areas have been opened up to large communities of enterprising prospectors and business people, and settlement in that far northern country of rigorous winter season is being largely extended.

In Mexico, and other independent republican States of Central America, vast progress in the industrial and intellectual life of the people are everywhere apparent. Great mineral fields have been discovered and widely developed, railroads have been constructed from the Atlantic to the Pacific, and large cities have been built on the sites of Indian encampments, or on places formerly occupied by dense tropical forests. International boundaries have been demarcated, and disputed territorial claims adjusted. The remarkable Isthmus of Panama is now being cut across from ocean to ocean, the daring enterprise of digging the canal being undertaken by the United States Government. And in South America, too, industrial enterprises are usually carried out on gigantic scales, one of the latest examples brought to the notice of the world being the establishment of direct communication between Argentina and Chile, by the great Transandine Railway, connecting Buenos Aires and the Atlantic with Valparaiso and the Pacific, the mighty Cordillera of the Andes being pierced by a tunnel two miles in length, and situated two miles above sea level. This means a big step in the development of the two great neighbouring Republics of Argentine and Chile, and will no doubt have an important bearing on the prosperity of the entire continent, Nor are these vast American countries behind the times in their contributions to geographical knowledge, or in the field of exploration and discovery. The Patagonian territory has been explored by representatives of the Argentine Republic, and the geological and physical structure of that inhospitable region investigated. The mighty rivers, mountains, lakes and valleys of Brazil have been forced to reveal their hidden secrets to the penetrating light of modern investigation, and in the pioneering work of research our local contemporaries have taken no inconsiderable part. Most

of the capital cities support active geographical organisations and other scientific institutions, for the diffusion of human knowledge, are established in the principal centres of population throughout the whole continent, extending as far north as the goldfields of Klondyke. And coming nearer home many important developments have taken place in the geographical work of Australasia during the period under review. In the Papuan territory alone, the last twenty-five years have witnessed some of the greatest exploratory achievements known in the history of that remarkably interesting country. The culminating ranges of the south-eastern portion of the island, terminating in Mt. Victoria, have been ascended, and their physical features elucidated. The hydrographical conditions have been examined, the geological structures investigated, the climatic factors recorded, and numerous important geographical discoveries made besides other valuable additions to scientific knowledge, in which the distinguished Patron of this Society has doubtless been the greatest contributor. Within the borders of the Dutch territory, comprising the north-western half of New Guinea, there is less to record in the nature of exploratory enterprise. The field work of the period being mostly confined to the seaboard and coastline. There is, however, an expedition now in the country sent out, for the purpose of exploring the lofty and unknown Charles Louis Range of Mountains, the culminating peaks of which are believed to be snow clad. And last of all, there is our own Australian Continent, where great activity has, during comparatively recent years, been manifested in the field of geography and exploration. This, however, has been chiefly restricted to the remote and little known areas of the central and northern regions, whose mineral resources and physical conditions have been investigated. But there is little to note in the nature of important geographical discoveries. Ethnologically much useful work has been accomplished, the primitive tribes inhabiting Central Australia have been studied and their conditions noted, while, on the western side of the Continent, our knowledge of the aborigines, scattered over the sparsely-populated and unsettled districts have been largely increased, chiefly through the services of Mrs. Daisy Bates, whose enthusiasm in the interests of the natives, as well as of that branch of knowledge to which she is devoted, is worthy of encouragement and sympathy. On the historical and political aspects of geography much might be said. Of the latter the most important is doubtless that associated with Federation, which became an accomplished fact some years ago, and is now a matter of history. Historically, the leading incidents connected with the development of the country as a whole, are for the most part merely of local interest.

and would hardly contribute to a more intimate knowledge of our undeveloped resources, or help to a better understanding of our social conditions.

Having in the briefest possible manner alluded to the more important geographical achievements of the period under notice, some slight reference may not unappropriately be made to the actual work of the Society during the same time. While this has mostly consisted of the holding of monthly and general meetings, at which papers have been read and discussed, the publication of same and the accumulation of a valuable library, the influence exercised by the Society upon the educational, intellectual, and industrial life of the State must have been considerable, and can hardly be estimated in any material form. It is, however, a fact worth noting that on its publications alone the Society has spent over £5,000 in hard cash, and materially the State may be said to have benefited to this extent, apart altogether from such other considerations as the influence and work of the Society, including its position as a channel of international communication, and a medium for the dissemination of reliable information concerning the State, to all parts of the world. This information is being supplied year after year to mercantile and shipping companies, public bodies and individuals, while the resources of the Society are frequently taxed to meet the heavy and constantly growing foreign demands for current and back numbers of the publications. In point of fact, the Society has for many years been discharging functions which rightly should have devolved upon the State, especially in its quasi official capacity as an inquiry bureau. "And all this work," it should be borne in mind, "has been done without costing the country a cent," as the newspapers remarked some time ago. As mentioned in the previous historical review, at the time of the Twenty-first anniversary celebrations, the papers read before the Society, and published in the "Queensland Geographical Journal," of which 25 volumes have been issued, are of a comprehensive nature, and deal with a wide range of subjects relating mainly to Queensland and other parts of Australasia, and these communications have been contributed by competent authorities, whose reliability has frequently been attested by the numerous quotations from their works that have appeared from time to time in the contemporary scientific literature of the world. An edition of several hundred copies of the "Journal" is sent out annually, in the form of exchanges, to all the civilised parts of the world. These exchanges are distributed at the cost of the Society, to Great Britain and Ireland, Austria, Hungary, Belgium, Denmark, Finland, France, German Empire, Greece, Holland, Italy, Norway, Portugal, Roumania,

Russian Empire, Spain, Sweden, Switzerland, China, French Indo-China, India, Japan, Siberia, New South Wales, New Zealand, Queensland, South Australia, Tasmania, Victoria, Cape Colony, Egypt, Natal, Argentine Republic, Bolivia, Canada, Chile, Peru, Columbia, Mexico, United States of America and West Indies. In exchange the Society receives the current publications of all kindred bodies, and of Government departments, and these are mainly the valuable works which constitute one of the largest and most representative libraries of the kind in Australasia, available at all times to the members for the purpose of reading or reference, and to the general public, under certain necessary conditions. It is, in point of fact, not generally known that a large number of popular monthly and weekly scientific journals come to hand by every English mail, brim full of up-to-date information concerning the progress of science, exploration, and discovery in every part of the globe. And many of these are profusely illustrated with maps, photographic reproductions, and coloured drawings of every description. Some of the American publications, especially, are got up in the most attractive manner, regardless of cost ; the artistic style being no doubt calculated to interest the reader and popularise the subjects illustrated. But several of the British journals, too, are not behind the times in their general get up, and in the interesting way in which their subjects are treated. But after all, this popularising tendency, if carried too far, may lead to lack of detail in the treatment of purely scientific subjects, which, for the purpose of reference, would be of little value.

As briefly mentioned in the third paragraph of this Report the Council having decided to award the Thomson Foundation Gold Medal of the Society to the President, Hon. Sir Arthur Morgan, F.R.G.S., for the very valuable services which he has rendered, a cablegram has been sent to London for the Medal, which will be presented to the recipient at the anniversary meeting.

On his arrival in Brisbane to assume the duties of Governor of Queensland, His Excellency Sir William MacGregor, who is one of the oldest Hon. Corresponding Members of the Society, was presented by the Council with an address of welcome. In replying to the address His Excellency said :—"Mr. President and Council of the Royal Geographical Society. Accept my sincere thanks for the kind and courteous Address with which you welcome myself and family to Brisbane. The work of the Queensland Branch of the Royal Geographical Society of Australia is well known and is much appreciated beyond this continent. It is recognised that your Society has had no small share in giving to geography that wide and extended scope that has made it in recent years one of the

most comprehensive branches of human knowledge. I have long been a member of your Society, in which I have always taken an interest in the past, an interest that will not be less in the future. I wish your Society much prosperity, and a career of continued usefulness."

Following the usual course adopted for several preceding years, the Council desires to recommend:—(1) The suspension of so much of the rules as provides for the payment of an entrance fee; (2) the re-appointment of Mr. A. S. Kennedy as Hon. Librarian, and of Mr. Robert Fraser as Hon. Auditor; (3) the re-appointment of Messrs. Alexander Muir and Robert Fraser, and the appointment of Lieut.-Col. James Irving as unofficial members of the Council. It is also recommended that Clause 10 of the Constitution and Rules of the Society be altered so as to admit of the election of one or more Vice-Presidents.

Taking advantage of Section IV. Clause 3 of the Constitution and Rules, the Council has decided to confer the Diploma of Fellowship upon the following members of the Society:—The Rt. Hon. Sir S. W. Griffith, G.C.M.G., etc. (Honorary), George Phillips, Esq. C.E., T. S. Sword, Esq., J.P., A. A. Spowers, Esq., J. P., R. H. Mathews, Esq., J.P., A. S. Kennedy, Esq., Hon. Librarian.

The Council, in warmly thanking all those who have so ably and loyally contributed to the success of the past session by the reading of valuable and interesting papers, desires to again express the obligations of the Society to Mr. A. S. Kennedy, the Hon. Librarian, and Mr. Robert Fraser, the Hon. Auditor, whose long and faithful services are greatly appreciated.

The thanks of the Council are also due to Messrs. J. A. Beal, H. W. Mobsby, and G. F. Matthews, for assistance rendered at the monthly meetings of the Society with the lantern.

STATEMENT OF THE ACCOUNTS OF THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND.

From 1st July, 1909, to 30th June, 1910.

Dr.

	£ s. d.	£ s. d.
By Funds at close of last account—		
,, Balance in Govt. Savings Bank ..	35 14 11	
,, ,, ,, Royal ,, ..	35 10 11	
		71 5 10
,, Annual Subscriptions Received ..	154 3 6	
		154 3 6
,, Donations towards expenses of the Society's Expedition to the Gulf of Carpentaria as per Balance Sheet hereto appended	31 12 0	
		31 12 0
,, Interest on Govt. Savings Bk. Deposit	1 1 0	
		1 1 0
		£258 2 4

Cr.

	£ s. d.	£ s. d.
To Expenditure as per accounts—		
,, Printing and Postage of "Journal" ..	53 0 0	
		53 0 0
,, Address to His Excellency the Governor	3 0 0	
		3 0 0
,, Expenses of the Society's Expedition to the Gulf of Carpentaria, as per Balance Sheet hereto appended ..	39 7 6	
		39 7 6
,, Hon. Treasurer..	30 0 0	
		30 0 0
,, Gas Account	4 3 11	
,, Fire Insurance Premium	1 12 6	
,, Sub to "Nature" and P.O.O. ..	1 11 6	
,, Expenses of Meetings, etc.	16 0 9	
,, General Postage, Printing Notices of Meetings, etc.	27 0 11	
,, Incidentals	4 6 2	
,, Hire of Chairs	2 8 0	
,, Advertising Meetings	1 16 0	
,, Generals	11 17 3	
		70 17 0
,, Exchanges	1 6 1	
,, Bank Charges	0 11 0	
,, Balance in Govt. Savings Bank ..	36 14 11	
,, ,, ,, Royal ,, ..	23 5 10	
		61 17 10
		£258 2 4

Examined with Bank Pass Books, Vouchers, etc., and found correct.

J. P. THOMSON, *Hon. Secy. and Treasurer.*

ROBERT FRASER, *Hon. Auditor*

21st August, 1910.

STATEMENT OF THE ACCOUNTS OF THE GULF EXPEDITION OF THE R.G.S.A.Q., 1910.

Dr.

By Govt. Grant	15 0 0	
,, Alexr. Corrie	5 0 0	
,, Geo. Phillips	5 0 0	
,, E. C. Barton	2 10 0	
,, Geo. Fox	2 0 0	
,, James Stodart	1 1 0	
,, E. E. Edwards	1 1 0	
		31 12 0

Cr.

To A.U.S.N. Co. Passage to and from Normanton	16 17 6	
,, Train fare Mareeba-Almaden	1 0 1	
,, Coach fare Charleston-Croydon	4 10 0	
,, Hotel expenses, refreshments, cab hire, telegrams and incidentals	9 9 11	
		31 17 6
,, Steel Box	1 1 6	
,, Baker and Rouse Account, plates, films, chemicals, etc.	6 8 6	
		7 10 0
		39 7 6

A/c submitted and approved by Council Debit Balance to be paid from the funds of the Society.

G. P., Vice-President.

13/1/10.

J. P. THOMSON,
Hon. Sec. and Treas.

Royal Geographical Society of Australasia.

QUEENSLAND.

FOUNDED 1885.

DIPLOMAS OF FELLOWSHIP.

The following gentlemen have been awarded the Diploma of Fellowship under Section IV. of Clause 8. Constitution and Rules (*See page 2 of Cover*) :-

Honorary:

His Excellency Sir William MacGregor, G.C.M.G., C.B., M.D., LL.D., D.Sc., Hon. F.R.S.G.S., etc.

The Right Hon. Lord Lamington, G.C.M.G., G.C.I.E., B.A., F.R.G.S., Hon. F.R.S.G.S., etc.

The Right Hon. Sir S. W. Griffith, G.C.M.G., M.A., etc.

Under subsections (a and b) :—

Charles Battersby, Esq., J.P.
Robert Fraser, Esq., J.P.
E. M. Waraker, Esq., J.P.
R. M. Collins, Esq., J.P.
Alexander Muir, Esq., J.P.
C. B. Lethem, Esq., C.E.
John Cameron, Esq., M.L.A.
Hon. Sir Arthur Morgan, Kt., F.R.G.S., etc.
Hon. C. F. Marks, M.D., M.L.C.
Hon. F. T. Brentnall, M.L.C.
James Stodart, Esq., M.L.A.
J. R. Atkinson, Esq., L.S. J.P.
L. F. Schoenheimer, Esq., J.P.
Ald. John Crase, J.P.
L. C. Horton, Esq., J.P.
J. T. Embley, Esq., L.S.
Rev. L. L. Wirt, B.D.
Capt. W. C. Thomson.
R. H. Mathews, Esq., L.S., J.P., etc.
T. S. Sword, Esq., J. P.
George Phillips, Esq., C.E.
A. A. Spowers, Esq., J.P., etc.
A. S. Kennedy, Esq.

LIST OF MEMBERS.

(P) Members who have contributed papers which are published in the Society's "Proceedings and Transactions." The numerals indicate the number of such contributions.

(PP) Past President.

A dagger (†) prefixed to a name indicates a member of the Council.

Life members are distinguished thus (*).

Should any error or omission be found in this list, it is requested that notice thereof be given to the Hon. Secretary.

Foundation Members

P1 Atkinson, J.R., J.P., FELLOW, Lic. Surveyor, Ipswich, Queensland.
Marks, Hon. C. F., M.D., M.L.C., FELLOW, Wickham Terrace, Brisbane
P1*Moor, T. B., F.R.G.S., F.R.S.Tas., Strahan, West Coast, Tasmania.
P1†Muir, A., J.P., FELLOW, 354 Queen Street, Brisbane.
P37PP*Thomson, J. P., LL.D., Hon. F.R.S.G.S., etc., Hon. Secretary and Treasurer, "St. Leonard's," Eagle Junction, Brisbane.

Members:

Affleck, Thos. H., "Westhall," Freestone, Warwick, Q.
Alford, Henry King, J.P., "St. Audries," Toowoomba, Queensland.
Allan, David Muir, Engineering Supply Co. Ltd., Edward Street Brisbane.
Allom, C. V., c/o B.P. & Co., Port Moresby, Papua.
Alison-Greene, Miss Alice J., Moreton Bay Girls' High School, Wynnum
Archer, Edward Walker, J.P., Targinnie Station, Yarwun, Queensland.
P2 Banfield, Edmund James, J.P., Brammo Bay, Dunk Island, via Townsville, Queensland.
*Barrett, Mrs. Walter, Eagle Junction, Brisbane.
†Barton, E. J. T., Bowen Terrace, New Farm, Brisbane.
Barton, E. C., New Zealand Buildings, Queen Street, Brisbane.
Battersby, C., J.P., FELLOW, Georgetown, Queensland.
Baynes, Harry S., Water Street, South Brisbane.
Beal, J. A., Lands Department, Executive Building, Brisbane.
Beck, John George Henry, J.P., Morton Street, Eidsvold, Q.
Bembrick, Rev. M. L.
B.I. and Q.A. Coy. (The Manager), Mary Street, Brisbane.
Blackman, A. H., Chief Engineer's Dept., Railway Offices, Brisbane.
Blair, Hon. J. W., M.L.A. Parliament House, Brisbane.
Borton, Mark W., Lands Office, Toowoomba, Queensland.
Bowden, Mrs. H., "The Mansions," George Street, Brisbane.
Boyce, Mrs. Rodney, "Kenilworth," William Street, off Ipswich Road, South Brisbane.

Bracker, Henry, J.P., "Glencoe," Clayfield, Brisbane.

P1†Brentnall, Hon. F. T., M.L.C., FELLOW, Vice-President, "Eastleigh," Coorparoo, Brisbane.

Broadbent, Kendall, Museum, Brisbane.

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